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The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XXXVI NO. 8

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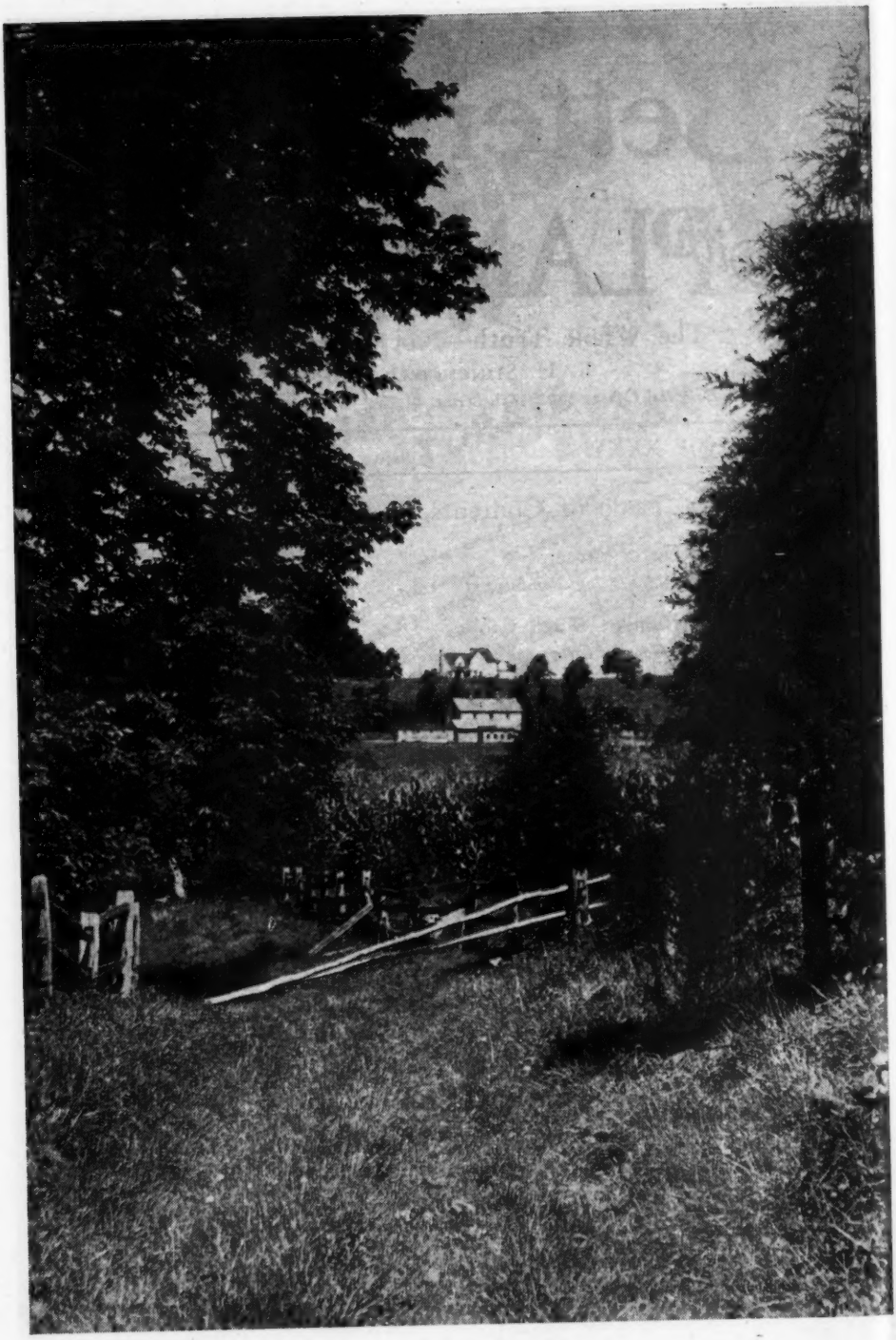

Hazy Days

Better Crops with PLANT FOOD

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VOL. XXXVI WASHINGTON, D. C., OCTOBER 1952 No. 8

We all hear . . .

Footfalls Unforgotten

Jeff McDermid

ECHOES and impressions of familiar footfalls on old streets of country towns seem closer and more real in the shorter days of autumn than they do in the heat and strong pulsations of a busy person's summertime. If you lived as a gauche kid in a rural trading town which had long since made up its mind to be itself and not clamor for commerce, you have the setting that brings back the figures on memory's screen. Sometimes in a few cases there are flutters and distortions with just a faint glimpse of the old reality, even as it is when you watch the telecast.

If your daily outdoor hours were spent in a calico shirt and short corduroy pants, long homeknit stockings in button shoes (or barefoot), and your tousled dome topped with a round straw hat; if you had a gray barn in the back yard where a brown cow was kept to replenish the larder and provide manure for a little garden; if a sand pile and a wooden cart, a stray kitten and a wicker sightseeing chair under the box-elder were your chief diversions—then the seance is set for the ghosts of other days. But we shall measure them also in the light of today.

The front yard was fenced with pickets and the gate about a rod from the cottage door swung on stiff hinges, with lilac bushes on either side. The outer walks beyond the fence were rough brick that heaved and rolled askew from the upthrust of ambitious tree roots; and the walks inside the yard that went back to the kitchen door were hardwood strips laid on buried two by fours. The box-elder grew on

a weedy lawn in the small front yard, where a tired and bored youngster could rest himself from imaginative play and listen for the wagon wheels grinding along in the macadam street and then hear the footsteps, quick or slow, of friendly citizens whose daily duties took them past his place.

UP early, and weary from customary make-believe, you waited for your first visitor. It was the milk wagon pulled by a lean gray horse, belonging to the husband of your mother's girlhood chum now possessed of a lucrative but none too sanitary dairy business. The wagon was what was known as a "democrat" with a canopy top and a high front seat behind which were kept extra cans of milk and cream. In the space beside the driver in the front seat were the dispensing outfit and a can or two for ready use. A handy ticket box was on the dashboard, with a slot to stuff your tickets in each day and a snap lid which opened to permit the sale of another week's allotment.

Within easy reach of the driver was a brass bell which he swung with vigor as he racked down the street, making each stop on routine with a clanging call for the household pitchers and pails. If Mother sent you to the curb, the driver bent down and took your pail, then opened a can and poured a measured quart into your receptacle, wiped away the dust and droplets, shooed away the sticky flies, and exchanged his lactic goods for your battered ticket or a nickel paid in cash.

When it comes to using the milk this man provided, a kid's memory brings back a juvenile gourmet's special liking for rich golden johnnycake crumbled up in a bowl of country milk, or sometimes the fragrance of hot and steaming oyster stew. As a gesture to the modern ways, it is only fair to recall certain feverish and uncomfortable periods as a short-pants consumer that may have had their origin in the household milk pitcher guilty of improper cooling and handling methods. This situation often brought us the doctor.

Our town had a doctor apiece for each church denomination. Without reporting what salvation of the soul and body our family preferred, it is to say that our physician rode up in a dashing two-wheeled shay, drawn by a sorrel gelding that always chewed gashes in the hitching post in some nutritional disturbance called "cribbing," which was a bad advertisement for the profession. Anyhow, the doctor was florid, tall, and confident of manner, wearing a frock coat, and bearing a case of vials and a metal and tube device to listen to your inwards with. He held your pulse, hummed and hawed, spoke of the weather, repeated a little harmless gossip not related to the oath of Hippocrates, and called for a set of tumblers filled with fresh well water. He mixed a few concoctions himself before your anxious eyes and left a dozen more in red, pink, and green folded papers, from which Mother was supposed to replenish the dope to dose you. No question was ever raised about the well water itself or the quality of the milk and fresh fruits which came each day unsuspected and unchallenged to the family table.

EACH spell of sickness had its own chapter from the Book of Job. When word got around that somebody at your house was under the weather, more familiar footfalls pattered down your street and turned in at the white gate. For the most part they were kind and solicitous, some bringing culinary tidbits and anecdotes of their own bad symptoms. Only a few of them were depressing and unwelcome. You lay in a feather tick on the big bed with the carved oak grapevines on the headboard, and felt as some prince giving orders to chefs, seneschals, and chamberlains, like the wonderful stories in the library books about ancient days.

There is no question that in those days the emphasis was on cures and

correctives rather than upon the arts of prevention. Prevention called for unheard-of civic organization and sacrifice, as well as modern medical laboratories such as we have today. In that potent field of our society the recent past is eclipsed by the achievements of today and tomorrow. The healer in the Prince Albert driving a gig deserves a cozy spot in the Ford museum, but few of us really want him back.

Another distinguished company in the town boy's fancy was the athletic

strong men of the times. Theirs was no exposition of sport records or public competition, like our boyhood physical heroes of the present. These men were the routine drudges of the everyday streets whose firm muscles and perfect coordination made them successful draymen and ice-haulers.

Big Mike Wells and Timothy Riley were the owners of the mighty footsteps which intrigued us. Rolling up the street in big-wheeled, heavy-framed wagons drawn by matched Belgians, these men aroused and held our admiration because—like our friends of the blacksmith shop—theirs was the craft of the strong and the hearty. Of such men were the pioneer wrestlers and wranglers made long before their exploits were pierced by the klieg lights and fanfare of television. If perchance a couple of them got a little tight on Saturday evening and brawled a bit for old-times sake, no entrancing record was made of their eye-gouging.

Mike Wells and his crew took the bills from the freight master at the red depot and loaded the various boxes and barrels for delivery downtown to the impatient merchants. Much of this lifting and straining is now reduced and simplified, and the overland trucks fetch in tons of goods direct to the main street destinations without using the railway depot routes.

We always waited for Tim Riley's covered ice wagon to halt for a delivery to Neighbor Goodrich across the street. Our own home relied upon the cellar and the roped bucket hung in the well to cool our provender, so we took no ice ourselves. While Tim was unloading and toting in 100-pound cakes of our frozen lake water, we eagerly picked up slivers of ice at the rear of the wagon bed, and sucked on them with keen relish.

But that event is no longer missed or waited for. Today we have electric refrigerators and rows of ice cubes, shelves and compartments of delicacies kept healthful and refreshing. Yet I doubt if many kids partake of the sport of clear-ice sucking as a genuine pastime—although it no longer takes one into the street in the splashing wake of an Atlas of the iron tongs.

ON very special and unannounced occasions our quiet Midwest street took on a strange and world-exploring flavor, when the Italian with the grind organ and the monkey or the dancing bear enlivened our humdrum scene. Those indeed were quaint footsteps out of countless library books and school geographies, proving visually to our untutored minds that the world is wide and other folks live different lives. In this same amazing category also belonged the Arabian and his little rugs and handmade laces, and the Syrian bearing on his shoulder a strap which fastened firmly a wicker basket of plaster figurines and statuettes. With

(*Turn to page* 50)

Fig. 1. Corn on very acid muck soil (pH 4.0). An 800-pound-per-acre application of 4-8-24 failed to produce any more growth than that shown in the foreground. A 5-ton application of ground limestone plus the same fertilizer (just beyond the stakes) gave a 41-bushel per acre yield. Be sure to have your soil tested.

The Nutrition of Muck Crops

By Paul M. Harmer

Professor of Soil Science, Michigan State College, East Lansing, Michigan

THE modern method of farming organic soils [1] in the U. S. A., including both mucks and peats, was largely developed in the last 40 years. Previous to that, practically all fertilization of these soils was done with manure unbalanced as it was for organic soils. In fact at the turn of the century, a bulletin was published by the then Michigan Agricultural College, as a result of two years of study, showing that commercial fertilizer was not satisfactory for the fertilization of muck soils. Reason for this inaccurate conclusion lay in the fact that the commercial fertilizer, which was used in comparison with manure, was a mixture suitable for crops on clay soils and did not contain sufficient potash to be suitable for those on muck.

[1] Since the word "muck" has been used almost entirely for many years to designate all organic soils in Michigan, including peats and mucks, that term will be used throughout this paper.

Crop Adaptability

In the early days of muck farming in Michigan, three special crops, celery, mint, and onions, were about the only ones produced on muck soil. Celery production originated in the United States and on Kalamazoo muck soil in 1856 and was grown commercially there from 1865 on. In Michigan, peppermint was first produced on mineral soils about 1835, but because of better yields, production was moved to the muck soils about 1875. Onions were first grown commercially on Michigan muck soil shortly before the close of the last century, but acreage did not in-

crease much for about 15 years.

Outside of the acreage in production of these three crops in the earlier days, many of the unbroken marshes were used for permanent pasture and for hay production. Oftentimes this land was not properly drained, with the result that the quality of the hay and grass was poor. The utter absence of any fertilization of these marshes, which unfortunately is still too often the case, resulted in the gradual removal of what little natural phosphate and potash there was in the organic soil, with consequent poorer and poorer quality of the hay and grass crops [2] harvested. The beneficial effect of different minor elements on muck under certain soil conditions was at that time entirely unknown.

Then followed a period of trial of other crops—potatoes, sugar beets, alfalfa, wheat. But muck-grown potatoes came to have a reputation for their inferior quality because they were fertilized with manure or with a mineral-soil fertilizer mixture. Now we find muck potatoes bringing a premium price for their high quality, brought about by the use of a high-potash mixture, such as an 0-10-30, with manganese or copper or borax, or a combination, sometimes needed for best results.

Sugar beets were tried as a muck crop about 1915, but soon the sugar companies rightly refused to contract beets on muck soil. A 15% sugar content was necessary for economical extraction of the sugar, whereas the low-potash fertilizer mixture used at this time produced a sugar content of 10 to 13%. Now we know that a 0-10-30 mixture, with copper sulfate added if the muck is acid, together with ordinary salt and sometimes a little borax on a crop planted fairly early to give a long growing season, will produce high yields of beets of 15 to 18% sugar content. The sugar companies are now glad to contract muck acreage for beet production, and the yields often run 50% higher than can be obtained from the neighboring upland.

Alfalfa had long been considered as not adapted to organic soil, due to the fact that it frequently was killed by winter heaving. Now we know that a high-potash fertilizer mixture on drained muck will produce high yields. Further, copper sulfate on the acid soil and manganase sulfate on alkaline soil will so stimulate root development that the alfalfa generally will show no win-

[2] For further information regarding fertilization of hay and pasture, see M.S.C. Extension Bulletin 304, "Muck Soil Management for Hay and Pasture Production," which can be obtained by addressing the Bulletin Room, M.S.C., East Lansing, Michigan.

TABLE I.—EFFECT OF VARIOUS FERTILIZER MIXTURES ON YIELD AND SIZE OF POTATOES GROWN IN ROTATION ON SLIGHTLY ACID (pH 6.0) DEEP MUCK

Treatment No.	Fertilizer analysis applied annually 1931–'41 600 lbs. per acre	Marketable tubers Bu. per acre		% by weight of A. size tubers	Av. weight per A. size tubers
		Av. 11 yrs. 1931–'41	Increase from fertilization		
1	0–0–0	76	.....	49.8	3.5
2	0–0–32	192	116	80.1	4.0
3	0–4–32	291	215	87.2	5.0
4	0–12–32	315	239	87.6	5.2
5	0–8–32	323	247	88.4	5.1
6	0–8–24	302	226	87.7	5.1
7	0–8–16	252	176	83.7	4.5
8	0–8–8	160	84	68.3	3.9
9	0–8–0	57	−19	33.9	3.1

TABLE II.—EFFECT OF VARIOUS FERTILIZER MIXTURES ON YIELD AND QUALITY OF TABLE BEETS—MICHIGAN MUCK EXPERIMENTAL FARM—1943 *

Plot order	Fertilizer analysis 1,000 lbs. per acre	Yield of beets Tons per acre	Sugar	
			% in beets	Pounds per acre
20	0–0–0	3.9	4.1	311
21	0–0–30	14.8	6.4	1,882
22	0–5–30	15.8	7.1	2,530
23	0–10–30	19.1	6.8	2,576
24	0–15–30	16.8	6.5	2,178
25	0–10–40	18.1	7.6	2,730
26*	0–10–30	17.6	7.2	2,520
27*	0–10–20	16.0	7.1	2,257
28*	0–10–10	12.4	6.1	1,501
29*	0–20–10	12.3	5.7	1,400
30	0–20–0	5.3	3.5	369

*Average of five replications.

ter injury from heaving where it has been given the proper nutrients. Borax also is likely to give added increases in yield.

For many years soils and crops scientists have advised against the raising of wheat on organic soil. In 1942 for the first time, we tried out wheat with and without copper on our new Michigan Muck Experimental Farm. Astonishing were the results of our trials in the next four years. We now can say to the prospective wheat grower on any organic soil which has not received copper in the past that he can expect 3 to 5 bushels per acre on properly drained muck with a 0-10-30 without the copper, and 30 to 50 bushels where copper is included in the same fertilizer mixture. Yorkwin winter and Henry spring wheat are the varieties that stand up best on Michigan muck soil.

So we might mention numerous other crops that produce good yields and high quality on organic soil, now that we know their major and minor element requirements. In some instances, new varieties have played a very important part. Thus development of Cornell 456 and Great Lakes varieties of head lettuce, coupled with greater knowledge of the use of proper fertilizers and minor elements, has resulted in a great increase in head lettuce production in Michigan[8]. Likewise the Flambeau soybean, with its earliness, has added another crop that formerly was not suited to organic soil because the common varieties failed to mature. Only one crop, cantaloupe, appears entirely unsuited to organic soil. We have never eaten a cantaloupe produced on muck that didn't taste like a pumpkin. Early varieties of watermelons on muck, on the other hand, have good quality when properly matured. Susceptibility of these last two crops to frost injury is a factor which must be taken into consideration in raising them and several others such as tomatoes and beans.

The Water Level

More crops on muck are lost because of poor drainage than from any other cause. Generally the poor yield or crop failure is due to a "fair weather" outlet, one that is very satisfactory in times of normal, well-distributed rainfall but inadequate in periods of excessive precipitation. Again the outlet may give excessive drainage in dry

[8] For further information regarding head lettuce production, see M.S.C. Extension Bulletin 303, "Muck Soil Management for Head Lettuce Production," which can be obtained by addressing the Bulletin Room, M.S.C., East Lansing, Michigan.

weather, with consequent greater chance of crop injury from wind or frost, and lower yields of celery, mint, head lettuce, potatoes, spinach, and other shallow-rooted crops.

Most important to the diversified muck farmer is a system of water control where, by the use of dams in the outlet and secondary ditches, the water level in different fields can be maintained, at distances below the surface, optimum for the crops being grown. Most muck farmers have a rather hazy idea as to where the water level is. This cannot be accurately judged by the level in the ditch, in fact in mucks underlain by springs, the water level may be considerably higher than the level in the ditch. Accurate knowledge of the position of the water level can be obtained by the installation of measuring wells[4] in strategic positions around the fields, with readings recorded weekly for reference in future years.

[4] Further information regarding water control and the construction and use of measuring wells can be obtained from M.S.C. Extension Bulletin 307, "Conservation of Michigan's Muck Soils," forwarded on request to Bulletin Room, M.S.C., East Lansing, Michigan.

Fertilizer Requirements

The great need for potash shown by most crops on organic soil has already been emphasized. Phosphate is also certain to be needed, although generally in lesser amount; while nitrogen may or may not be required, the requirement depending on several conditions.

Nitrogen. Properly drained deep muck soil that has not required liming for satisfactory crop production ordinarily does not need nitrogen for the production of general crops. Organic soil ordinarily contains from 2 to 4% total nitrogen in the soil itself. Nitrogen may be required in the following instances:

1. For leafy or for early-sown crops under all conditions. This includes such crops as celery, lettuce, mint, onions, and spinach. In seasons of early warm weather, crops like onions and mint may not require nitrogen if

Fig. 2. Spinach on newly broken virgin deep muck. No fertilizer in the foreground, potash only just beyond the first stakes, phosphate and potash beyond the second stakes. Yields in the same order: 0.9, 2.3, and 5.2 tons per acre.

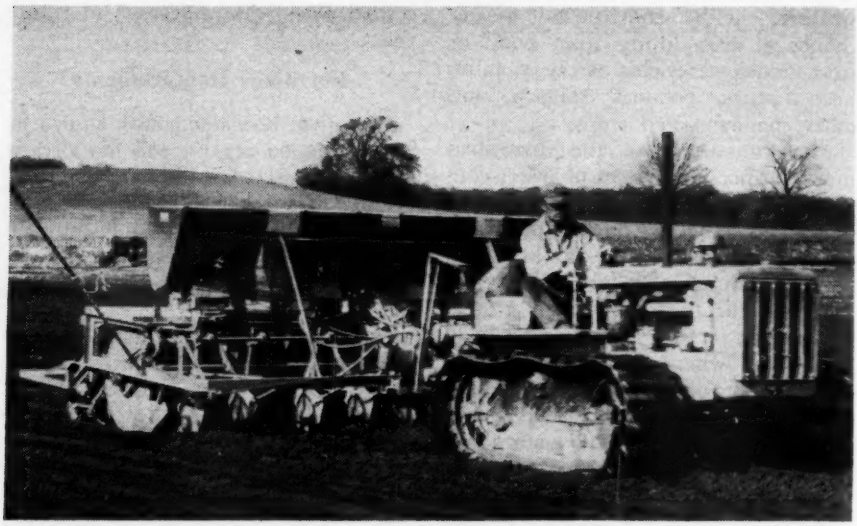

Fig. 3. Showing combination of multiple fertilizer distributors ahead and seeders behind, designed to put fertilizer under the row. The weight of the whole implement is carried by the roller. A half day spent in the field at the beginning of the season, in carefully adjusting the fertilizer distributors so the fertilizer is directly below the seed, then a further check two or three times a day during the period of seeding, will pay off in increased yields at harvest.

the muck is fairly new and well drained.

2. For all crops where soil has required a lime application for satisfactory crop production.

3. For most crops as a topdressing or sidedressing immediately following an excessively wet period. This is especially important for mint, celery, lettuce, spinach, onions, corn, and sometimes even potatoes. Where leaching has been excessive due to heavy rainfall, potash and sometimes phosphate should also be included in the sidedressing. Thus a 10-10-10 sometimes may give better results than the same amount of nitrogen applied in the form of ammonium nitrate.

4. Additional sidedressing during growth with normal rainfall. Two or three applications generally are needed for celery, one two to three weeks before harvest for spinach, leaf lettuce, and sometimes for head lettuce, and one at the last cultivation or about tasseling time for corn.

5. On poorly drained muck, need for nitrogen is greater but application may be wasted if drainage is extremely poor. Proper water control will increase the length of life of muck by delaying excessive decomposition but by so doing it may also increase the nitrogen requirement of the crops produced.

6. Muck under production for many years is likely to reach a finely divided condition approaching the end of decomposition, with less nitrogen available from the soil and a consequent greater nitrogen requirement for many crops.

7. The closer the planting of row crops, the less the amount of nitrogen which each plant can obtain from the soil and consequently the greater will be the need for applied nitrogen.

Phosphate. Phosphate increases crop growth on organic soil when sufficient potash is present. It is most important in hastening growth and maturity of the crop. Because of its effect on maturity, it is frequently advisable to use more phosphate than potash in the fertilizer mixture for a couple of years for peppermint, onions, and sometimes head lettuce, on muck soil which has

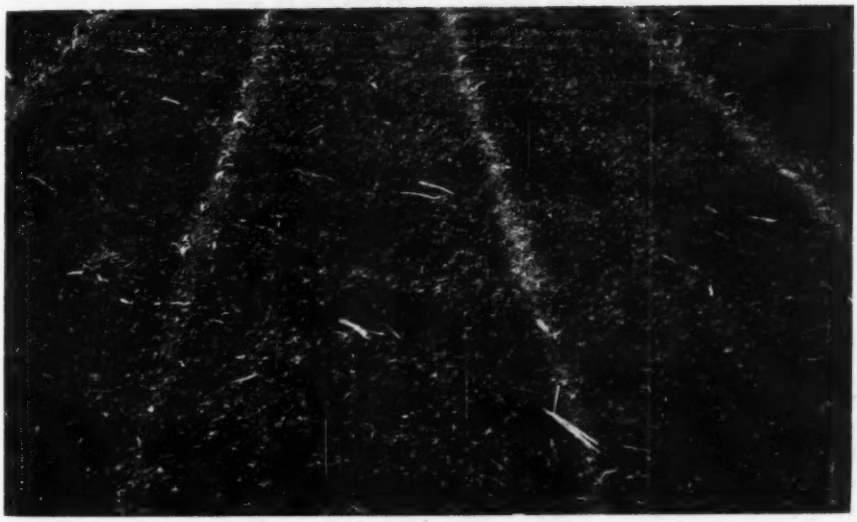

Fig. 4. On this finely granular dry muck surface at time of planting, the fertilizer supposedly was applied on each side of the corn seed. Actually the fertilizer slid down the slope and landed in one band just above the seed, as evidenced by the one light colored streak of fertilizer residue which came to the surface with the evaporating moisture. The large percentage of albino plants was also proof of fertilizer injury to the sprouting corn. Most of the modern corn planters do not have positive control of fertilizer placement. Best way of avoiding this injury is to plant when the surface is moist and compact. Then examine for position of fertilizer from time to time in planting. Because of injury to stand, the above field was disked up and replanted immediately after photographing.

not been well fertilized in preceding years.

Potash. This is the most important constituent in the fertilization of organic soil. It is very important in increasing growth of both tops and roots, as well as in increasing the sugar and starch contents of many crops. Its effect is generally much greater when some phosphate is included in the mixture. An excess of potash is not likely to lower yields except in the cases of onions where it may delay maturity, of mint where it may produce a tall stemmy growth with resultant lodging and low oil yields, and of head lettuce where it may increase tipburn.

Fertilization

In Fig. 5 is shown the effects of increasing the proportion of potash in the fertilizer mixture on yields of several crops. On this graph the average of several years (7 to 11) of yields are expressed in tons of marketable topped carrots, beets, and onions, of above-

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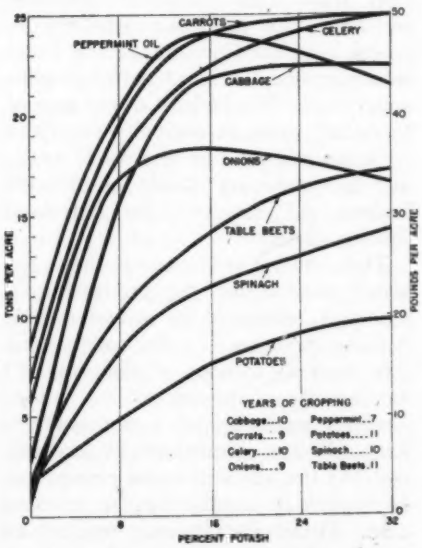


Fig. 5. Graphic representation of average yields of eight crops grown in rotation on a slightly acid (pH 6.0), well-drained, deep muck soil. Yields of all crops are calculated in tons per acre except of peppermint oil which is in pounds. Drainage was very satisfactory for carrots, cabbage, onions, and table beets but the yields of celery, peppermint, spinach, and potatoes probably would have averaged higher if the water level had been higher during July and August.

The Mineral Uptake by the Sweet Potato[1]

By L. E. Scott and W. L. Ogle

Department of Horticulture, University of Maryland, College Park, Maryland

THE sweet potato ranks among the list of our most heavily fertilized vegetable crops. "Sweets" are grown to their highest point of perfection on the light sandy soils along the Atlantic and Gulf Coasts, but these same soils that are necessary to produce high quality are also notoriously deficient in plant nutrient content. Generous application of fertilizer is a must, if the sweet potato is to produce the yields for which it is inherently capable.

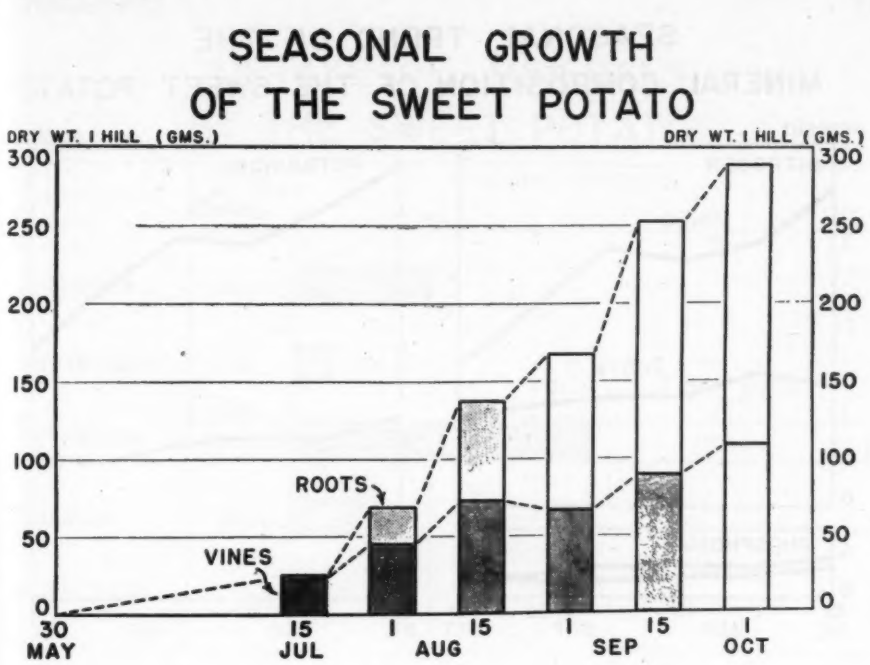
For many sections, applications of more than 1,000 pounds of fertilizer per acre, with particular emphasis on a high potassium percentage, are being recommended for sweet potato production. In the Wicomico County area of Maryland, growers normally use about 1,500 pounds per acre of a 3-9-12 analysis, in producing yields of 350-400 bushels per acre of the Maryland Golden variety.

The amount of supplemental fertilizer needed for the production of a crop is influenced by several factors. Among these are (1) the native available mineral content of the soil, (2) the capacity of the soil to "fix" added fertilizer materials in a non-available state, (3) loss of nutrients by leaching, and (4) the actual mineral element requirement or uptake by the growing crop. Detailed exploratory research on this last factor has been undertaken at the Maryland Agricultural Experiment Station. Certain findings of the work will be presented here.

[1] Miscellaneous Publication No. 133, Contribution No. 2360 of the Maryland Agricultural Experiment Station, University of Maryland (Department of Horticulture).

Knowledge of the seasonal rate of utilization and the total uptake of the various mineral elements by the sweet potato plant when considered together with the other factors mentioned should be of value in determining the rate and timing of fertilizer applications to the crop that would result in most efficient utilization and resultant production. To obtain actual data on the subject, measurements of vine and root growth and concurrent chemical analyses of samples were made periodically on a crop of Maryland Golden sweet potatoes at the University of Maryland Vegetable Research Farm near Salisbury in 1950. The crop was handled in a manner similar to the usual commercial production practices in that area. Planting was made with the use of a starter solution on May 30, with half of a 1,500-pound-per-acre application of 3-9-12 fertilizer applied June 23 and the remaining half applied July 11. Beginning on July 15, 10 hills were dug by hand from each of 12 plots and the fresh weights of vines and roots recorded. Dry weight percentages were calculated by oven-drying a portion of the material. This procedure was repeated at two-week intervals until final harvest of the crop on October 1. The data given in the charts represent the average values for the 12 samples.

The seasonal increase in growth of the vines and roots is shown graphically in Figure 1 as the dry weight of matter produced by one hill at the several sampling dates. In the first six weeks of the entire 16-week growing season, or by July 15, less than one-tenth of the



final total dry matter was accumulated. At that date the root crop was beginning to be formed, and from then on until harvest the greater part of dry matter accumulation was in that portion of the plant. About 40 per cent of the growth as measured by dry matter production occurred in September, the last month of the growing season.

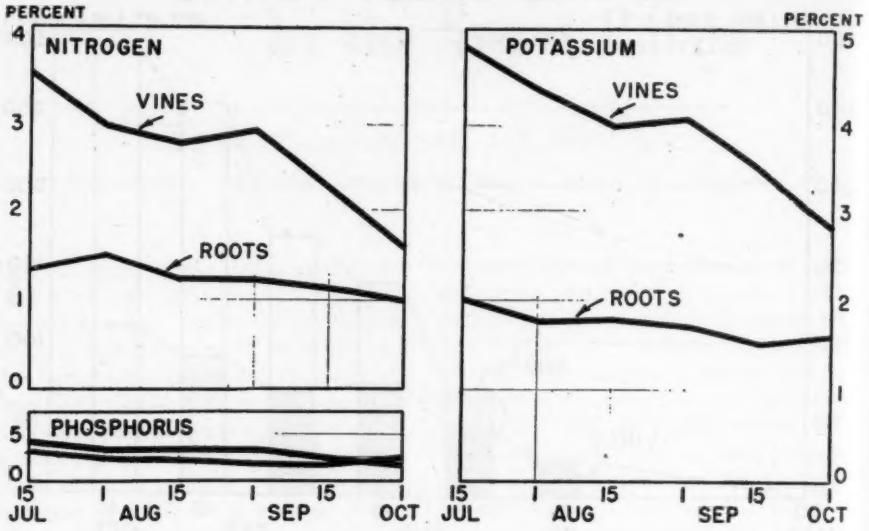
The seasonal trends in the percentage composition of nitrogen, phosphorus, and potassium are shown in Figure 2. In all instances there is a tendency toward a seasonal decrease in concentration of the nutrient element as growth of the plant increases. This decrease is much more accentuated in the vines than in the roots, and occurs to a greater extent with nitrogen and potassium than with phosphorus. Since the charts for the three elements are presented on the same scale, Figure 2 also shows the great differences in percentage composition of N, P, and K in the sweet potato. This will be brought out later in greater detail.

The total seasonal uptake of the five elements, N, P, K, Ca, and Mg was determined by the weights and percentage composition of the roots and vines at the time of harvest and is given in Figure 3. Phosphorus and potassium are expressed as the oxides, P_2O_5 and K_2O; the others in elemental form. The uptake of potassium is about twice that of nitrogen and five times as great as the uptake of phosphorus. If the two elements were both expressed in the elemental form, the uptake of calcium would exceed that of phosphorus. Magnesium is present in about half the amount of calcium.

The mineral content of the harvested crop of roots represents a permanent loss of nutrient elements from the soil. About half of the total uptake of nitrogen, potassium, and magnesium is present in the roots at the time of harvest. About one-third of the phosphorus and four-fifths of the calcium are found in the vines.

The four-month growing season of the sweet potato crop with which the experiments were carried out may be divided at the halfway point on August

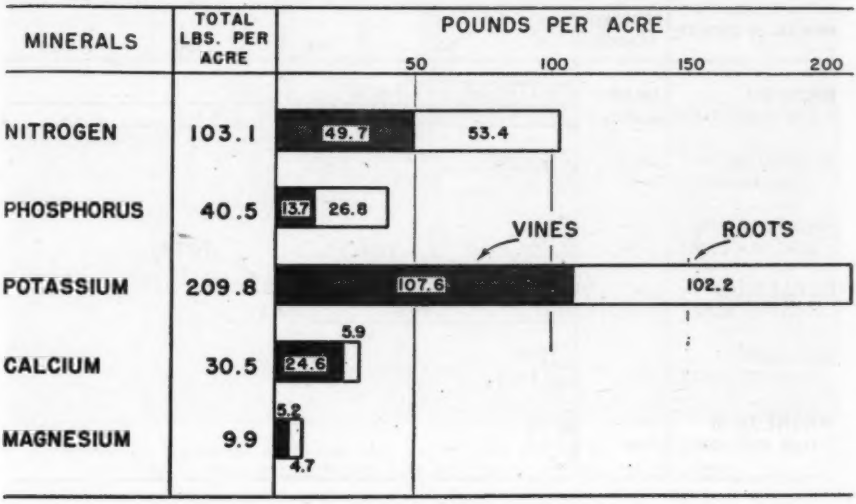
SEASONAL TREND OF THE MINERAL COMPOSITION OF THE SWEET POTATO



1, and calculations of growth and mineral uptake in the first and last half of the season compared. Although it is seen (Figure 4) that about 75 per cent of the total growth (as measured by dry matter accumulation) took place in the last half of the growing season, the total uptake of the different elements, excepting phosphorus, is approximately equally divided between the two halves. This, of course, is a result of two factors: first, as stated earlier, the concentration of the mineral element in the plant tissues declines as the season progresses; and second, by far the greater portion of the growth during the latter half of the season is represented by the expansion of the root crop, and it has been shown that the percentage composition of minerals in the roots is decidedly lower than that of the vines. The heavy utilization of nutrient elements in the production of the root crop is shown by the fact that 80 per cent or more of the uptake of N, P, and K, during the last half of the season is accounted for by the increase in the amounts of these elements found in the roots. In fact, it was found that there was little or no increase in the absolute amounts of N, P, or K in the vines after August 15.

All of the data point out the relatively great utilization of potassium by the sweet potato plant. This, of course, has been recognized in the results of fertilizer plot work with the crop, and has led to recommendations of the use of fertilizer formulae of high potassium content. In the present studies the crop uptake of potassium was 30 pounds per acre in excess of the amount applied in the fertilizer application of 1,500 lbs. per acre of 3-9-12. For several reasons, it is difficult to assume that the uptake was in a "luxury" range. In the first place, excess uptake over applied potassium occurred on a soil relatively low in native available potassium; secondly, the rapid decrease in percentage composition of the vines during the latter part of the season would not indicate luxury consumption; and finally, other fertilizer studies with sweet potatoes on this soil have indicated increased yields resulting

UPTAKE OF MINERALS BY THE SWEET POTATO

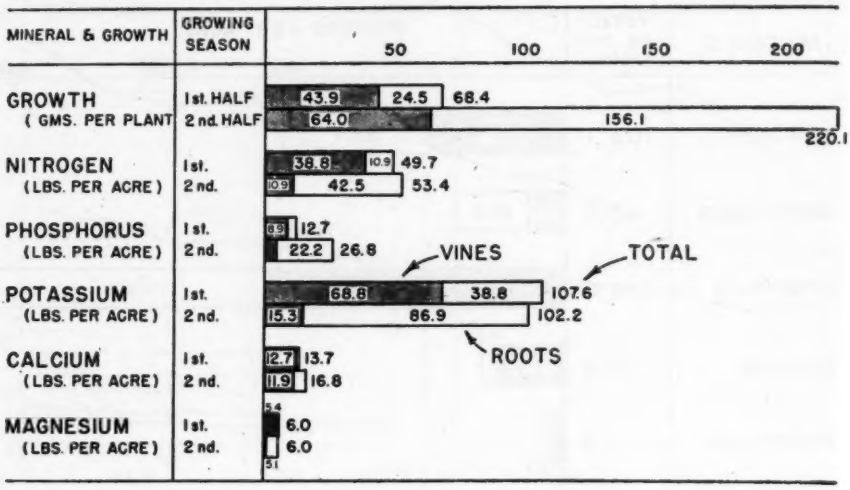


from higher potassium applications than that used in this test (1). In an earlier study (10) comparing the potassium uptake of the varieties Maryland Golden and Porto Rico, much the same results were obtained with Maryland Golden as in the present tests. On a heavier soil but with the same fertilization program, the K_2O uptake was found to be about 250 lbs. per acre. The Porto Rico has been found to have a higher concentration of potassium in both vines and roots than the Maryland Golden. The absolute total uptake, however, may not be greater since the Porto Rico normally produces smaller crops in the Maryland area.

In the present study, about twice as much nitrogen was found in the sweet potato vines and roots at harvest as had been applied in the fertilizer treatment. In fact, the amount removed in the harvested crop slightly exceeded the 45 lbs. of N applied. This particular crop followed a crotalaria cover crop which undoubtedly left a considerable nitrogen reserve. However, it is perhaps significant that higher yields were obtained from plots which received a doubled nitrogen application and supplemental irrigation. On unirrigated plots the extra nitrogen did not increase yields. It is quite possible that other reported instances of failure to respond to nitrogen have been due to the concurrent presence of certain other limiting factors. Although it has been found that a greater incidence of cracking is sometimes associated with high rates of nitrogen fertilization, it is not believed that nitrogen per se, is the causal factor of cracking.

It has been shown that the uptake of potassium and nitrogen by the sweet potato may exceed the amounts applied by fertilization. In striking contrast the uptake of phosphorus is less than one-third that supplied in the 1,500 pound application of 3-9-12. The portion removed in the crops is about one-fifth of the amount applied. Difficulties arise in applying such a balance sheet in the formulation of recommendations for phosphorus fertilization. On many soil types such an excess application of phosphorus is necessary because of the fixation of a large proportion of the applied phosphorus in a form unavail-

GROWTH & MINERAL UPTAKE BY THE SWEET POTATO IN THE FIRST AND LAST HALF OF GROWING SEASON



able or only very slowly available to the plant. However, sandy soils of the type usually used in sweet potato production have a relatively low phosphorus "fixing" power, and it has been found that the available phosphorus content of such sandy soils may actually increase significantly under a fertilization program for crop production (4, 6, 7). For these reasons and since there have been few reported instances of response of the sweet potato to phosphorus fertilization on Coastal Plain soils (2, 3, 8, 9, 12), it is suggested that in many instances the amount of phosphorus contained in the recommended analyses for sweet potatoes may be greater than necessary. It is interesting that a 3-3-15 formula was recommended by the Virginia Truck Station on the basis of sweet potato fertilizer experiments carried out in the 1920's (12).

The calcium requirement for the sweet potato as indicated in the total uptake data is quite adequately supplied by the calcium associated with the phosphate in the fertilizer, or present in the limestone "filler."

The magnesium uptake is relatively small in comparison with the other elements, but instances of magnesium deficiency and response to magnesium fertilization on sweet potatoes (1, 5) have been found in New Jersey and Maryland. The low magnesium content of the sandy soils and rapid loss of magnesium by leaching would justify the incorporation of magnesium in the fertilizer program for sweet potatoes.

Summary

A study of the seasonal mineral uptake by the Maryland Golden sweet potato grown in Wicomico County, Maryland, emphasizes the high rate of potassium utilization by this crop and the relatively low requirement for phosphorus. Nitrogen uptake was found to exceed the amount supplied in the fertilization program. About half of the total uptake of nitrogen and potassium and two-thirds of the phosphorus were found in the harvested crop. Utilization of nitrogen and potassium is about equally divided between the first and last half of the growing season, although about 70 per cent of the total growth, as measured by dry matter production, takes place in the

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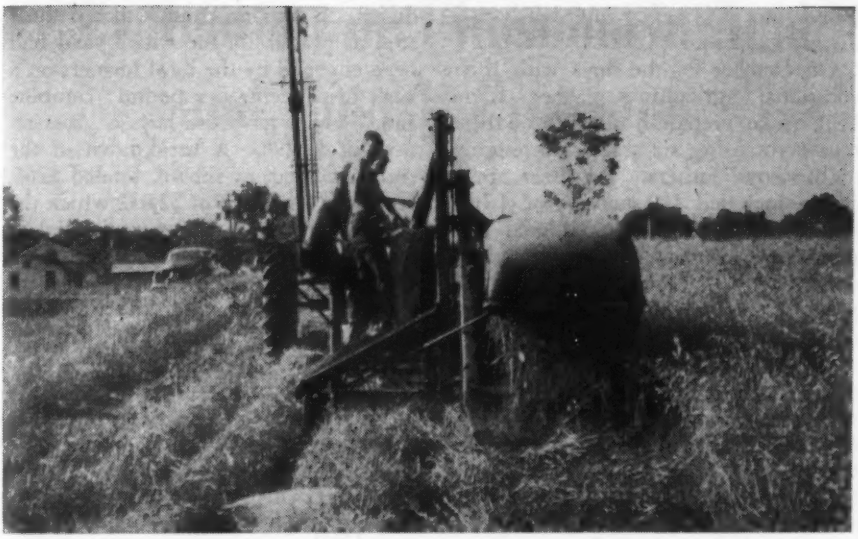

Fig. 1. Combining operations on Rescue seed patch. The growth was so heavy that it became necessary to make only 2-ft. cut with combine to prevent choking down.

Rescue—A Profitable Seed Crop

By Bill Nichols

Sylacauga, Alabama

RESCUE grass—a stemmy type of brome grass and a first cousin of our native Cheat—appears to have a great future in the South. Introduced into Southern agriculture a few years ago by the Soil Conservation Service, this grass is in wide demand for fall seeding alone or in clover mixtures for fall and winter grazing.

Its coarse, stemmy foliage in combination with crimson clover makes a top-grade grazing combination, and Rescue provides the necessary insurance in this mixture to prevent bloat. One of the most remarkable characteristics of this grass is its ability to produce a heavy seed crop following heavy fall and winter grazing, a factor which adds to its adaptability into the Southern grazing program.

The best seed yield which we know about was made by a group of farm boys in Shelby County, Alabama, who are members of the Columbiana chapter of The Future Farmers of America. The land used to produce this seed was a four-acre block of idle school property of low fertility. The club members got together and decided to put this acreage in Rescue grass to be combined for seed in the spring of 1952. At the suggestion of Work Unit Conservationist B. F. Hatchett, the North Central Soil Conservation District loaned the boys 100 pounds of Chapel Hill strain Rescue seed. This particular strain was se-

lected since it is very winter-hardy and disease-resistant.

On October 24 the boys with their vocational agriculture teacher, Elvin Hill, broke, prepared, and planted these four acres using six tractors belonging to the boys' fathers. Fertilizer application included 500 pounds of 4-10-7 before planting. An additional 500 pounds per acre of 6-8-4 were broadcast on February 8, and a few days later this plot was topdressed with 200 pounds of ammonium nitrate per acre.

A small check plot was used to demonstrate the value of topdressing in the spring months for growth and seed production, and this plot did not receive the February 8 application of fertilizer. This seed plot of Rescue attracted hundreds of visitors throughout the spring months who came to view this new grass introduction and who marveled at the extremely heavy growth of the grass even in coldest weather. Much interest was evidenced in the small check plot which received no spring fertilizer.

The seed were combined on May 30 by the entire chapter, and a total of 7,660 pounds of air-dried seed was produced. It was no trouble to sell these seed as practically the entire yield had been engaged by the local farmers on a basis of 30 cents per pound "combine run," which gave the boys a gross return of $2,298. A breakdown of the costs involved, as shown, totaled $266, leaving a net profit of $2,032 which the Columbiana FFA Chapter planned to use for a trip to Florida. A part of the balance of this money will be used to purchase equipment for the shop and the rest will go into the club treasury.

Mixed fertilizers	$ 85
Nitrate	28
Machinery, gas, and repairs	70
Sacks, needles, thread, tags	53
Seed borrowed	30
Total	$266

This seed project gave the FFA class a first-hand opportunity to study Rescue as a crop, including the planting, fertilizing, and combining of the seed. The seed crop is a valuable source of seed for the farmers in the county who recognize the value of Rescue for winter grazing and as a hay crop. Many

(*Turn to page* 48)

Fig. 2. Elvin Hill, Vocational Agriculture Instructor, and B. F. Hatchet, Soil Conservation Service Technician, explain to FFA group the value of heavy rates of fertilizer as evidenced by bumper crop of seed being combined.

Evaluation of Phosphoric Acid and Potash Programs

By Myron A. Bachtell

Department of Agronomy, Ohio Agricultural Experiment Station, Wooster, Ohio

FIFTY years ago the fertility experiments at the Ohio Agricultural Experiment Station gave indications of the primary role that phosphoric acid was destined to play in the productivity of Ohio soils. Later on potash assumed increasing importance. Today, especially where grassland culture makes up a considerable part of the cropping program, potash requires special watching in order that crop yields are not adversely affected by a gradual and unnoticed diminution of the replaceable potash in the soil. Furthermore, commercial nitrogen is being increasingly used and its maximum efficiency is not possible where either phosphoric acid or potash can act as a limiting factor.

Laboratory facilities for testing soil samples to determine the levels of phosphoric acid and potash availability are being increasingly used by farmers. By giving a current inventory of these nutrients, the tests tend to indicate the net effect of past years of soil management and to serve as more or less valuable bases for charting future treatments. Laboratory reports, however, can well be supplemented by home-worked formulae which evaluate the general efficiency of any fertility system in meeting the needs for phosphoric acid and potash. Such evaluation may help to explain the net results of past treatments as shown by laboratory tests. But of greater importance it may serve to increase confidence in whatever system is adopted for the years ahead. Any measure that points the way to a more dependable future level of soil productivity creates a feeling of security in the operator that adds to the satisfaction of farming.

Evaluation of the fertility treatment from the standpoint of phosphoric acid and potash perhaps is easier than from that of nitrogen. The needs of the two minerals are best determined when requirements are considered for the rotation as a whole and these are correlated with the soil type and the soil inventory of any particular farm or field.

Long-time soil fertility tests have been conducted at 11 widely scattered locations in Ohio. Treatments with phosphate alone and with a phosphate-potash mixture on certain plots were started during the period 1911 to 1917 at most of these locations. The data in Table I were taken during the period 1934 to 1946 and thus represent results after approximately two decades of definite treatment. All land was well limed so that soil reaction was not a limiting factor in crop growth. Check plots received neither manure nor fertilizer. It is assumed that the crop yields on these plots were largely determined by the amount of phosphoric acid given up by the various soils involved. This assumption is based on the fact that the long-time fertility tests which were started at Wooster about 1900 showed the first step (on limed land) toward larger crop yields was the application of phosphoric acid. Nitrogen and potash increased yields only slightly when applied where phosphoric acid was omitted. Therefore, it seems logical to take the yield of crops on

TABLE I.—PHOSPHORIC ACID AND POTASH RELEASED ANNUALLY PER ACRE AT 11 LOCATIONS IN OHIO. 1934-1946

(Not strictly comparable as the rotations varied in different tests)

Rate of release	Location of test	Rotation	Treatment started	Phosphoric acid	Potash
	County	Crops	Year	lbs.	lbs.
High	Paulding	C.O.H.H.	1933	29	110
Medium	Wayne	C.O.W.H.	1915	20	70
Medium	Miami	C.O.W.H.	1917	18	71
Medium	Hamilton	C.W.H.H.	1912	18	65
Medium	Madison	C.W.H.	1917	13	58
Medium	Trumbull	C.O.H.H.	1915	16	74
Medium	Mahoning	C.O.W.H.	1915	14	54
Medium	Belmont	C.W.H.	1917	13	52
Medium	Washington	C.W.H.	1914	14	60
Average of medium release soils				16	63
Low	Clermont	C.W.H.H.	1911	9	39
Low	Meigs	C.W.H.	1903	7	36
Average of low release soils				8	38

C=Corn O=Oats W=Wheat H=Hay

these unfertilized plots as a fairly good indication of the amount of phosphoric acid that these soils were releasing for plant use.

Crops were not analyzed but the amounts of phosphoric acid per acre were computed by applying proportionate parts of the figures given in Table II. According to this method the average release for 8 locations was 16 pounds per year, for 2 locations it was only 8 pounds, and for 1 location it was 29 pounds or twice the average of the other 10 locations.

On one plot in each test the only fertilizer applied was superphosphate. It is assumed that on this plot the yields were largely determined by the amount of potash that crops were able to obtain from the soil. Here again the logic of this assumption is supported by the long-time fertility tests at Wooster. Potash rather than nitrogen was the effective first step upward from the phosphated level. Nitrogen had its maximum efficiency only after both phosphoric acid and potash had been applied. For these reasons the use of crop yields on phosphated plots is taken as a workable guide in estimating the probable release of potash from the different soils under various cropping conditions.

At 8 of the 11 locations the patterns of potash removal were fairly consistent although rotations used were not the same at all 8 places. Amounts varied from 52 to 74 pounds with an average of 63 pounds per acre per year. The comparable figure for two other locations averaged a low of only 38 pounds and for one location it was a high of 110 pounds per acre per year.

The 11 locations are fairly well scattered over Ohio but of course this number cannot measure all conditions in the State. To indicate the complexity of that problem it is only necessary to point out that the generalized soils map now used in the State contains six main divisions according to soil origin. These are broken down into 24 sub-divisions containing over 50 names such as Woo-

ster, Miami, and Brookston. In addition there is a further breakdown with a half dozen descriptive terms such as clay, silty clay, silty clay loam, clay loam, silt loam, and sandy loam. All of this indicates that Ohio soils vary greatly in such things as content of plant nutrients, physical condition, drainability, aeration, and potential productivity.

Three experiments which have been conducted in Ohio indicate that the evaluation of a fertility system from the standpoint of phosphoric acid is comparatively simple. They furnish evidence that it is good practice to have the fertility system carry from 1 to 1½ or even 2 times as much phosphoric acid as the crops remove. Locations of these tests were at Wooster, the Mahoning County, and the Trumbull County Experiment Farms. All are in the medium release group and all located on the glaciated shale soils of eastern Ohio rather than on those of limestone origin in western Ohio. But except for the high release soils of northwestern Ohio the rule of returning as much as or more phosphoric acid than the rotation uses is considered a safe guide for Ohio farmers. On many farms, one-fourth or more of the amount returned will be near the corn rows with the remainder drilled or spread rather evenly over the entire area. In general, this liberality of return is intended to build up the potential fund of available phosphoric acid which crops can draw on for the maximum yields that weather conditions permit.

Fig. 1. Fulfillment of leguminous promises is dependent on balanced fertility programs.

The Handbook of Ohio Experiments in Agronomy recently published by the

TABLE II.—LARGE CROPS REQUIRE LARGE AMOUNTS OF PLANT NUTRIENTS

Crop	Yield per acre	Average amount contained in crop			
		Phosphoric acid		Potash	
		Component parts	Total	Component parts	Total
		lbs.	lbs.	lbs.	lbs.
Corn, ears	80 bu.	31	.....	29	.....
stover	4,800 lbs.	7	38	62	91
Oats, grain	60 bu.	14	.....	9	.....
straw	3,000 lbs.	9	23	60	69
Wheat, grain	40 bu.	24	.....	12	.....
straw	3,800 lbs.	6	30	36	48
Timothy hay	2.5 T.	.....	18	.....	81
Red clover hay	2.5 T.	.....	20	.....	95
Alfalfa hay	2.5 T.	.....	24	.....	121
Alfalfa hay	4.0 T.	.....	38	.....	193
Alfalfa-timothy (half and half)	4.0 T.	.....	34	.....	162

Ohio Agricultural Experiment Station contains the figures given in Table II. It should be noted that large meadow yields contain as much phosphoric acid as do large corn yields. For either corn or meadows the figure may approach or even exceed 40 pounds per acre. Although oats and wheat require less, it is easily apparent that almost any rotation that contains corn and one or more years of high-yielding meadow will use

Fig. 2. Big yields, whether of corn or grass, contain large amounts of plant food.

a yearly average of over 30 pounds of phosphoric acid per acre. On the basis of returning from 1 to 2 times as much as the rotation uses the return of phosphoric acid may be anywhere between 30 and 60 pounds per acre per year. Where laboratory tests show a low inventory of available phosphoric acid the standard of return should approach the larger figure rather than the smaller. In many cases, however, an evaluation of the entire manure and fertilizer program will show that even the lower standard is not met. In making this evaluation each ton of manure should be credited with 4 or 5 pounds of phosphoric acid (or 3 to 4 pounds for each load) and the fertilizer for what it actually carries.

With analyses that contain 12 per cent of phosphoric acid it requires 1,000 pounds to supply 120 pounds. During a recent year 90 per cent of the fertilizer tonnage sold in Ohio was represented by analyses that contained 12 per cent or less of phosphoric acid. It is feared that many farmers are not using the poundage per acre of these fertilizers during the rotation that may be required to supplement the manure so as to obtain even a minimum annual average of 30 pounds per acre. The use of analyses carrying larger per cents such as 16 or 20 naturally tends to increase the amount of phosphoric acid that is applied during the rotation. The most common setting of fertilizer drills probably is 300 pounds per acre and many farmers are disposed to leave it there regardless of whether high or low analysis goods are used.

In evaluating potash return the problem is more complicated. It is impossible to strike an average and say that this should be the average annual return regardless of all other factors. Reference to Table II shows that big hay crops may contain from 2 to 4 times as much potash as big grain crops. A grain rotation may be satisfied with a relatively low return of potash but each year of high-producing meadow has a marked effect on increasing the potash requirements. Then Table I shows that Ohio soils vary greatly in the amount of potash they easily give up to crop growth. The average at 8 locations which comprise the medium group is approximately 60 pounds per acre per year. The problem is to be fairly sure that these 60-pound annual increments are used during the rotation and still not rely so heavily on this source that the level of replaceable potash becomes unduly low. The cost of 60 pounds of potash, when purchased in mixed commercial fertilizers, probably exceeds $4. True, it is that in these days of free spending this amount of money does not seem too large and there may be many who are inclined to think that this acre value is not too important. But on 100 acres of tillable land the value is more nearly $400 per year. Moreover, if these annual increments can be made

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By-products of Research

By Howard V. Jordan[1]

State College, Mississippi

SIR Isaac Newton developed the law of gravitation while serving as Director of the Subproject for Apples, which was part of a Master Project for Fruit Improvement. This research was sponsored by the Government of Great Britain in cooperation with a syndicate of British fruit growers. Newton, attracted more by the fall of an apple than by its quality or production capabilities, developed interests far afield from those of the horticulturists, and he pursued his interests to their logical conclusion. Thus the by-products of research are sometimes of equal or greater value than attainment of the original objectives. History does not record any great contributions which Newton made to the breeding, quality improvement, or better cultural methods for apples which were objectives of his study. Every school child learns of his law of gravitation; its applications are legion.

Within recent years, studies by the agricultural research agencies in the South have shown the great possibilities for increasing corn yields in this area. Heavier rates of fertilization, particularly with nitrogen, thicker stands, adapted hybrids, and better cultural practices are the multifactor formula by which the higher yields are obtained. Studies of the main objective have been highly productive, yet there are by-products of the research which have equally valuable implications.

Recently a five-year study of fertilizer and management practices for corn in the hill section of Mississippi was summarized.[2] Recommended practices evolving from this study are outlined below:

1. ***Fertilization:*** In the hill and delta foothill sections apply at planting time 300 pounds of 12-8-8, 500 pounds of 8-8-8, or 600 pounds of 6-8-8 per acre, depending on needs as shown by a soil test. Sidedress with 60 to 90 pounds of nitrogen per acre. (In the delta section apply 90 to 120 pounds of nitrogen per acre in one pre-planting or in split applications.)
2. ***Spacing:*** Leave plants 15 inches apart in 42-inch rows or 16 inches apart in 40-inch rows. This stand aggregates approximately 10,000 plants per acre. From 9 to 14 pounds of planting seed will be required—a little less than one peck.
3. ***Variety:*** Plant an adapted hybrid. These are available for all parts of the State.
4. ***Planting:*** Prepare a good seedbed on well-drained soil. Plant just before cotton-planting time.
5. ***Cultivation:*** Practice shallow cultivation until the corn is knee-high. Avoid late or deep cultivation.

The average yield of corn in the experiments was 22 bushels per acre where no nitrogen was applied and the corn was thinned to the once-prevalent stand of 4,000 plants per acre. Where 120 pounds of nitrogen were applied and the stand was in-

[1] Soil Scientist, Division of Soil Management & Irrigation Agriculture, B.P.I.S.A.E., U. S. Department of Agriculture in cooperation with the Mississippi Agricultural Experiment Station.

[2] Mississippi Experiment Station, Bulletin No. 486. December, 1951.

creased to 12,000 plants per acre, the average yield was 72 bushels per acre. This represents a return of 50 bushels of corn from the application of 120 pounds of nitrogen and the adoption of improved management practices.

But the newer production practices did more than this. Corn in high-fertility plots and fields is growing in a new equilibrium. Illustrative of this is one experiment on the Agronomy Farm at State College, which was conducted for four years and is still in progress. The experiment involves six treatments, listed in Table I, with their respective yields (see also Figure 1). These treatments were directly superimposed on the same plots each year. This experiment was studied intensively in an effort to determine what makes the treatments tick.

By-Products of High-Fertility Practices

It early became evident that the high-fertility practices had a number of incidental advantages which were not anticipated at the outset of the study.

An aid to weed control. Well-fertilized, thickly-spaced corn grows off quickly to provide a canopy that "shades out" much of the grass and weed competition normally present in Southern cornfields. This is shown by the photograph of the State College experiment in Figure 2. It has been found that high-fertility practices for corn will normally save one cultivation in a season. In fact the plants grow off so quickly that there just is not time for the usual number of cultivations before corn reaches the lay-by stage.

These high-fertility practices have been made an integral part of the recommended procedure for controlling weeds in Southern cornfields by use of herbicides.

Nitrogen fertilizers increase protein in corn. As the rate of nitrogen applied in the State College experiment was raised, the crude protein content of the grain increased. With the 4,000-plant stand, crude protein increased from 8.24 per cent with no nitrogen to 10.85 per cent with the 120-pound-nitrogen application. With the 12,000-plant stand, crude protein was consistently lower at equivalent nitrogen rates; the corresponding range was from 7.62 to 9.98 per cent. Comparing the no-nitrogen, 4,000-plant treatment with the 120-pound-nitrogen, 12,000-plant combination, crude protein was raised by 1.74 per cent. On an acre basis this is equivalent to the protein in somewhat more than 1,000 pounds of cottonseed meal.

Corn is primarily a carbohydrate feed, but it contains an appreciable and valuable amount of protein. In the decade of the 1940's the protein of commercial corn is said to have declined from an average of 9.5 per cent

TABLE I.—YIELDS OF CORN IN FERTILIZER-SPACING EXPERIMENT AT STATE COLLEGE, MISSISSIPPI. 1947-1950.

Treatment [1]		Acre yields of corn				
Nitrogen	Plants	1947	1948	1949	1950	Mean
lbs/acre	*no/acre*	*bu*	*bu*	*bu*	*bu*	*bu*
0	4,000	31.4	29.3	21.2	35.8	29.4
60	4,000	54.3	71.4	64.5	68.9	64.8
120	4,000	56.0	73.7	67.9	77.3	68.7
0	12,000	22.4	36.3	33.7	47.6	35.0
60	12,000	61.8	77.6	71.2	90.2	75.2
120	12,000	92.2	103.4	100.4	121.8	105.5

[1] All treatments received a uniform application of phosphoric acid and potash.

Fig. 1-A. The baskets represent four-year average yields of corn in an experiment at State College, Mississippi, with a stand of 4,000 plants per acre and nitrogen rates as indicated. Yields (left to right): 29.4 bushels, 64.8, and 68.7 bushels per acre.

or higher to 8.5 per cent or lower. This decline is a matter of considerable national concern. Protein in the grain of the high-fertility treatment of the experiment at State College was raised above the early national level.

High-fertility treatments increase crop residues. The by-product of these studies which has perhaps the most intriguing possibilities is the increase in crop residues resulting from

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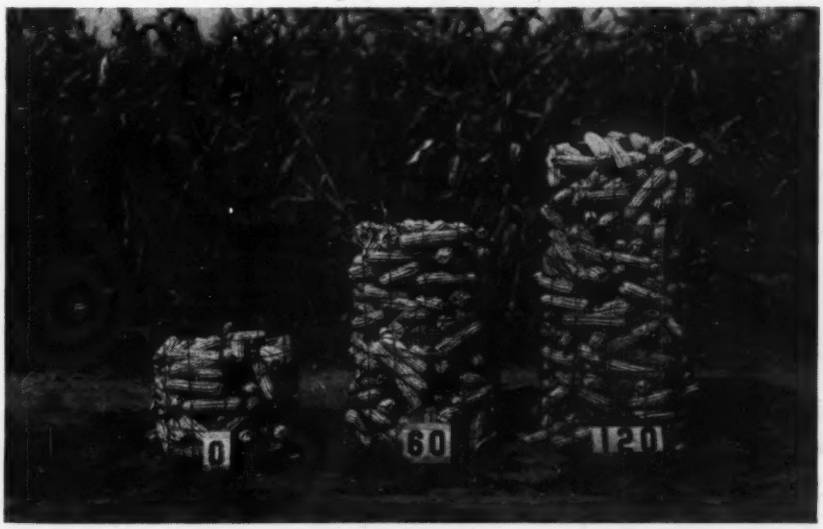


Fig. 1-B. Yields of corn with a stand of 12,000 plants per acre and nitrogen rates as indicated were (left to right) 35.0 bushels, 75.2, and 105.5 bushels per acre. Fertilizer rate and stand must be kept in balance for efficient production.

Fertilizing Corn for— Yield, Protein, and Oil

By H. J. Snider

Agronomy Department, University of Illinois, Urbana, Illinois

THE yield and quality of corn are affected by a number of conditions, but a large production of grain is basically dependent upon an ample supply of essential plant-food elements. When plant nutrients in the soil are sufficient, the corn grain will contain higher percentages of both oil and protein. This takes into consideration that adapted hybrids are used along with accepted cultural methods and suitable controls for weeds and insects. The normal amount of moisture and sunlight is also necessary.

Southern Illinois farm land in an unimproved condition is very likely to reach an extremely low level of productivity. On this kind of land, crop production is so low and of such quality that farm animals are frequently underfed and otherwise poorly nourished and the economic condition of the farm people may be on a substandard level.

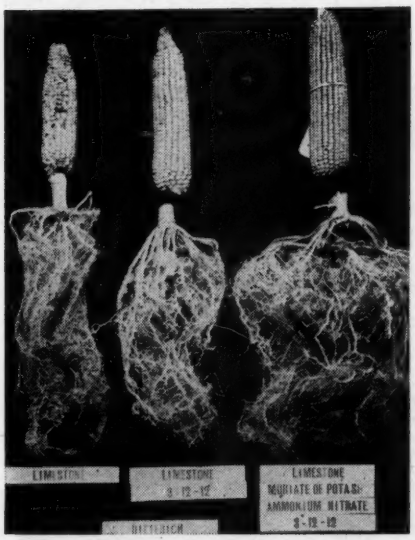


Fig. 1. Corn roots and ears from the Dieterich Field, September 18, 1951. Corn on left treated with limestone, yield 19 bushels. Center treated with lime and 200 lbs. 3-12-12, yield 66 bushels. Right treated with lime, 300 lbs muriate of potash, 190 lbs. ammonium nitrate, and 200 lbs 3-12-12, yield 92 bushels.

The redeeming feature is that this type of soil can be readily brought into high production by a land-management program which includes about all the known devices for soil improvement and its conservation. There must be first a liberal use of limestone and a somewhat regular succession of legume-grass crops, some of which must be used to bolster up soil organic matter and supply some nitrogen. Phosphorus must be added in the more soluble superphosphate forms or in the less costly, finely ground rock phosphate or a combination of the two. Potassium and nitrogen must be added at opportune times and in generous amounts. There is also evidence that a number of trace elements are needed to put production and quality on a high level. Magnesium should be added in dolomitic limestone. There is considerable evidence that boron is needed by some crops and some indication that sulphur may be used to an advantage. There is apparently no one key element in this fertility merry-go-round, but all must be in the soil in sufficient quantities to promote satisfactory production.

Heavy fertilization increased both yield and quality of corn. In Table I are shown corn yields from various soil treatments along with the protein and

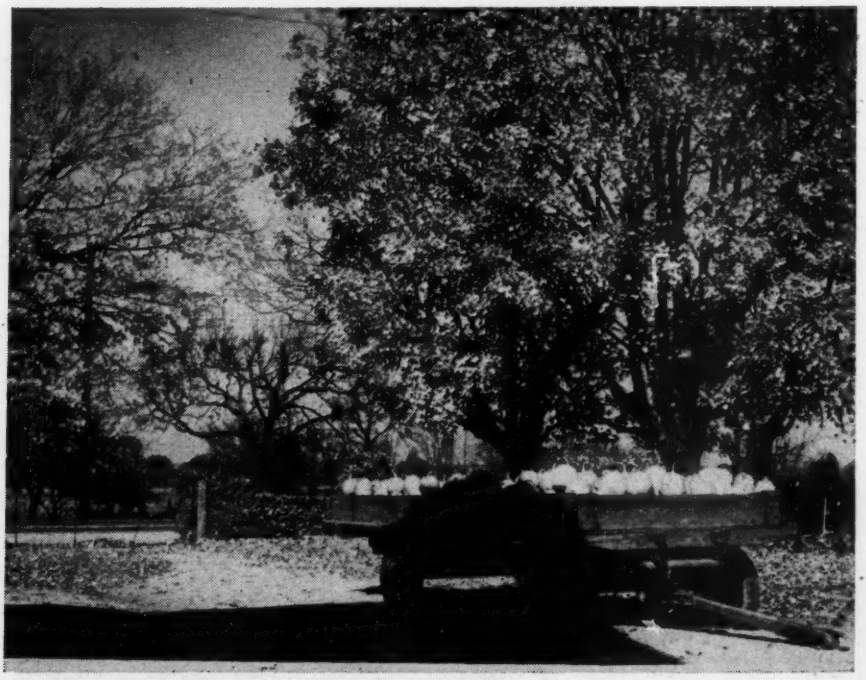
(*Turn to page* 44)

PICTORIAL

Fall in the Suburbs

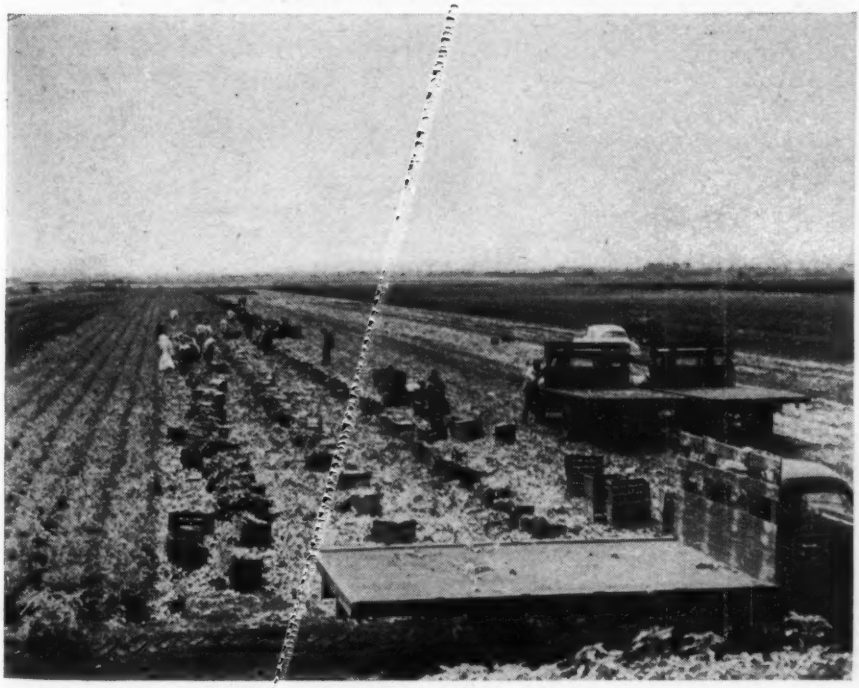
Above: Cotton bales ready for market.

Below: A good load of pumpkin pies.

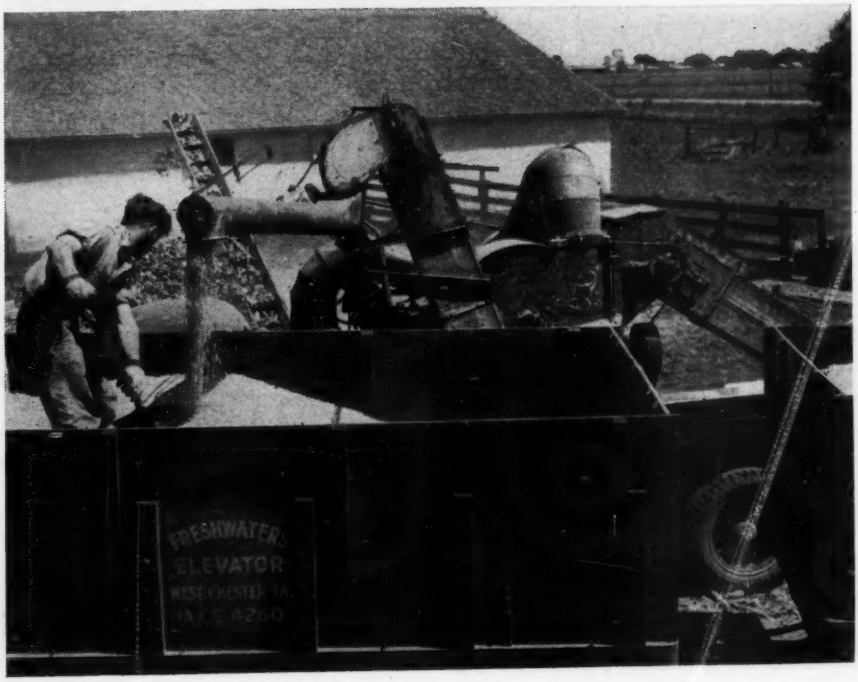


Above: Cabbage to pep up winter appetites.

Below: Harvesting long rows of celery.



Good Exercises for Weak Backs



The Editors Talk

Our Cover Picture

Perhaps no crop has more of the "Horatio Alger" in its story of success in America than the tomato. Originating in tropical America and first mentioned as a food in this country in 1781 by Thomas Jefferson, it now occupies a place among our vegetable crops topped only by the potato. Its value to growers in 1950 is estimated at well above $175,000,000, and each year has found agricultural science increasing the possibilities of producing more tons per acre.

Important in this research work has been the study of soils and their fertilization to meet the requirements of tomatoes. And because tomatoes utilize large amounts of potash—in fact more than all of the other minerals put together—growers should know the content of available potash in their soils and the fertilizer analyses that will make up the deficiencies.

When deficiencies of potash are not corrected, the tomato plant reacts with well-defined starvation symptoms. Growth is slow, the plants are stunted, and the yield is small. Older leaves will turn an ashen-gray green and then develop a yellowish green along the margins. The injury progresses from the margin toward the center of the leaflet, which is followed by the development of large, light-colored spots between the larger veins. Affected areas often turn a bright orange color and frequently become brittle. The leaves turn brown and finally die. Stems become hard and woody and fail to increase greatly in diameter, remaining slender. The roots do not develop. They remain slender and are often brown in color, and secondary thickening does not occur. Potassium deficiency may have a decided effect on the shape, solidity, and quality of the tomato fruit. Fruit on plants getting a large amount of potash matures dark red and carries a high amount of sugar and acid, factors in high quality tomatoes. Fruit on plants showing extreme deficiency may ripen unevenly and lack solidity. In our cover illustration, normal fruit and leaf appear on the left; potash-starved on the right.

According to Dr. Jackson B. Hester, Soil Technologist, Department of Agricultural Research, Campbell Soup Company, "The amount of potash absorbed by the plant may offer some interesting information upon how to fertilize the crop. For example, only a small amount of potash is needed by the tomato plant during the first month after the plants are set in the field. A large supply is needed during the second month, but a still larger supply is necessary during the third month. These results show that a large part of the potash is used in the fruit and thus permanently removed from the soil. Therefore, tomatoes need an adequate supply of potash for proper functioning supplied largely during the second and third months after the plants are set in the field.

"When 1,000 or more pounds per acre of fertilizer carrying over 5 to 7 per cent of potash are used under the row before planting, the young plants are likely to be injured or killed and therefore it may be advisable to use potash as a sidedresser or broadcast before planting. Muriate of potash broadcast before

planting has been suggested. However, since potash applied before planting may injure the young plants and since it is subjected to leaching and fixation until the plants have reached a good size, it is believed that sidedressing with muriate of potash or the application of high-potash mixtures as a sidedressing may be a satisfactory method of applying adequate potash. Some growers are afraid to apply fertilizer in the middle of the row for fear the tomato plant will not be able to take it up. A single plant has been known to have a root spread of 24 square feet and to penetrate the soil 3 feet or more. So, a tomato crop will absorb any available plant material within reasonable distance of the stalk."

More and More Fertilizer

Some interesting facts are to be found in the August 1952 issue of RURAL MARKETING—News and Trends of the Farm Market, published monthly by COUNTRY GENTLEMAN. Citing U. S. Department of Agriculture's estimate that "the use of fertilizer accounts for 25 per cent of this country's crop production," it is stated that an all-time high of 18.7 million tons of commercial plant food was used on farms last year, more than double the amount of a decade earlier. And though the national gain was only four per cent in 1950-51, such states as Nebraska increased the take by 65 per cent, New Mexico 48 per cent, and Arizona 41 per cent.

The average price of the commodity has risen only about 50 per cent since 1935-39, contrasting with today's farm wage rates, for example, which are now 232.5 per cent above the 1939 mark. Most farm costs have more than doubled during that time.

A decided increase in the use of fertilizers is seen in a statement by Secretary Brannan that "the food and fiber needs of the fast-growing population would require fertilizer production increases of 50-70 per cent in the next three years," and five main points are stressed to show farmers why it is advisable to treat land with fertilizer:

1. The necessity for producing larger crops from smaller acreage (acreage harvested in the United States fell from 353 million in 1945 to 336 million in 1950).
2. Newly developed varieties of many crops, because of their larger size and better quality, drain the soil of nutrients at a faster rate than previous varieties.
3. Fertilizer changes not only the chemical character but the physical quality of the soil, enabling it better to resist erosion.
4. Fertilizer in addition to increasing yield improves the nutritive value of crops as well.
5. The old standbys of crop rotation and use of farm refuse and manure, while still essential, can only partially replace the plant food consumed in crop harvesting and land erosion.

In 1950, about 2.5 per cent of cash farm income went for fertilizer. The research done by the Curtis Publishing Company concludes: "It has been variously estimated that from 30-300 per cent more commercial fertilizer could be used by the average farmer and still produce a profitable farm operation."

Erratum: We regret that in connection with his article appearing in the August-September issue of this magazine, the address of M. T. Vittum was given as "Department of Vegetable Crops, Cornell University, Ithaca, New York." Dr. Vittum is Associate Professor, Division of Vegetable Crops, New York Agricultural Experiment Station, Geneva, New York.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1926.....	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927.....	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67 1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932..	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91 7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	45.9	128.0	214.0	124.0	188.0	16.50	43.40	....
1950.....	40.1	51.6	91.6	173.0	153.0	200.0	16.70	86.50	....
1951									
September...	33.73	52.4	123.0	287.0	165.0	207.0	16.55	66.10	....
October.....	36.21	57.7	139.0	271.0	164.0	210.0	17.15	69.90	....
November....	41.00	50.0	174.0	280.0	162.0	219.0	18.35	72.70	....
December....	40.34	51.0	193.0	305.0	169.0	222.0	19.65	71.50	....
1952									
January.....	38.70	46.2	207.0	347.0	168.0	220.0	20.75	70.10	....
February....	37.25	33.8	205.0	357.0	166.0	218.0	20.65	67.10	....
March.....	36.72	23.5	216.0	383.0	165.0	220.0	20.35	61.50	....
April.....	37.30	15.0	231.0	416.0	168.0	218.0	20.05	60.80	....
May.....	36.08	43.5	264.0	433.0	170.0	213.0	18.65	60.80	....
June.....	38.02	44.0	310.0	436.0	173.0	206.0	17.05	61.90	....
July.....	37.02	42.0	274.0	446.0	173.0	198.0	17.25	71.00	....
August.....	37.92	48.8	278.0	410.0	173.0	204.0	19.35	69.80	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1926.....	101	179	189	134	116	138	112	98	139
1927.....	163	207	146	124	132	135	87	154	127
1928.....	145	200	76	134	131	113	95	152	154
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	129
1931.....	46	82	66	83	50	44	73	40	115
1932.....	52	105	55	62	50	43	52	46	102
1933.....	82	130	118	79	81	84	68	57	91
1934.....	100	213	64	91	127	96	111	146	95
1935.....	90	184	85	80	102	94	63	135	119
1936.....	100	236	164	106	163	116	94	148	104
1937.....	68	204	76	89	81	109	74	87	110
1938.....	69	196	80	79	76	64	57	97	88
1939.....	73	154	100	84	88	78	67	94	91
1940.....	80	160	78	97	96	77	64	96	111
1941.....	137	264	116	105	117	107	82	211	129
1942.....	153	369	168	134	143	124	91	202	163
1943.....	160	405	188	235	174	154	125	231	245
1944.....	167	420	214	216	170	160	139	234	212
1945.....	181	366	205	232	198	170	127	227	207
1946.....	263	382	178	248	212	209	141	319	182
1947.....	257	380	232	248	336	259	148	381	226
1948	245	482	222	253	201	226	155	298	214
1949.....	231	459	184	244	193	213	139	192	201
1950.....	323	516	131	197	238	226	141	384	185
1951									
September...	272	524	176	327	257	234	139	293	161
October.....	292	577	188	309	255	238	144	310	171
November...	331	500	250	319	252	248	155	322	249
December....	325	510	277	347	263	251	166	317	331
1952									
January.....	312	462	297	395	262	249	175	311	337
February.....	300	338	294	407	259	247	174	298	217
March.....	296	235	310	436	257	249	171	273	265
April.....	301	150	331	474	262	247	169	270	308
May.....	291	435	379	493	265	240	157	270	285
June.....	307	440	445	497	269	233	144	275	250
July.....	299	420	393	508	269	224	145	315	287
August.....	306	488	399	467	269	231	163	310	229

Wholesale Prices of Ammoniates

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4 96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5 50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7 38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9 85
1949	3.15	2.29	10.11	13.18	10.73	10.62
1950	3.00	1.95	11.01	11.70	10.21	9.36
1951						
September	3.13	2.07	11.50	10.78	9.26	9.26
October	3.13	2.07	12.85	11.28	10.56	10.32
November	3.34	2.07	13.93	11.28	10.39	10.25
December	3.34	2.07	14.27	11.28	10.08	10.02
1952						
January	3.34	2.07	14.27	11.28	10.39	12.16
February	3.34	2.07	14.27	11.28	11.61	11.08
March	3.34	2.07	14.26	11.28	9.71	9.04
April	3.34	2.07	14.26	11.28	8.80	8.05
May	3.34	2.07	14.25	11.28	7.75	7.36
June	3.34	2.07	14.27	11.28	8.38	8.38
July	3.34	2.07	14.26	11.28	8.19	7.59
August	3.34	2.07	14.26	11.28	9.78	7.89
			Index Numbers (1910-14 = 100)			
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
1950	112	68	315	331	303	266
1951						
September	117	73	329	305	275	263
October	117	73	365	320	313	293
November	125	73	398	320	308	291
December	125	73	408	320	299	285
1952						
January	122	73	408	320	308	345
February	125	73	408	320	344	315
March	125	73	407	320	288	257
April	125	73	407	320	261	229
May	125	73	407	320	230	209
June	125	73	408	320	249	238
July	125	73	407	320	243	216
August	125	73	407	320	290	224

Wholesale Prices of Phosphates and Potash * *

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
1950	.763	3.83	5.47	.371	.716	14.33	.195
1951							
September	.810	3.98	5.47	.386	.768	14.72	.193
October	.820	3.98	5.47	.386	.768	14.72	.193
November	.820	3.98	5.47	.386	.768	14.72	.193
December	.820	3.98	5.47	.420	.827	16.00	.210
1952							
January	.820	3.98	5.47	.420	.827	16.00	.210
February	.820	3.98	5.47	.420	.827	16.00	.210
March	.832	3.98	5.47	.420	.827	16.00	.210
April	.840	3.98	5.47	.420	.827	16.00	.210
May	.860	3.98	5.47	.420	.827	16.00	.210
June	.860	3.98	5.47	.353	.708	13.44	.176
July	.860	3.98	5.47	.386	.768	14.72	.193
August	.860	3.98	5.47	.386	.768	14.72	.193
			Index Numbers (1910-14 = 100)				
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
1950	142	106	112	68	75	59	83
1951							
September	151	110	112	70	81	61	82
October	153	110	112	70	81	61	82
November	153	110	112	70	81	61	82
December	153	110	112	75	87	66	85
1952							
January	153	110	112	75	87	66	85
February	153	110	112	75	87	66	85
March	155	110	112	75	87	66	85
April	157	110	112	75	87	66	85
May	160	110	112	75	87	66	85
June	160	110	112	65	74	56	80
July	160	110	112	70	81	61	82
August	160	110	112	70	81	61	82

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1926.....	146	150	146	119	94	135	112	86
1927.....	141	148	139	116	89	150	100	94
1928.....	149	152	141	121	87	177	108	97
1929.....	148	150	139	114	79	146	114	97
1930.....	125	140	126	105	72	131	101	99
1931.....	87	119	107	83	62	83	90	99
1932.....	65	102	95	71	46	48	85	99
1933.....	70	104	96	70	45	71	81	95
1934.....	90	118	109	72	47	90	91	72
1935.....	109	123	117	70	45	97	92	63
1936.....	114	123	118	73	47	107	89	69
1937.....	122	130	126	81	50	129	95	75
1938.....	97	122	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	123	130	127	86	56	130	102	77
1942.....	158	149	144	93	57	161	112	77
1943.....	192	165	151	94	57	160	117	77
1944.....	196	174	152	96	57	174	120	76
1945.....	206	180	154	97	57	175	121	76
1946.....	234	197	177	107	62	240	125	75
1947.....	275	231	222	130	74	362	139	72
1948.....	285	250	241	134	89	314	143	70
1949.....	249	240	226	137	99	319	144	70
1950.....	256	246	236	132	89	314	142	72
1951								
September.	291	271	258	135	94	300	151	73
October...	296	272	259	140	94	335	153	73
November.	301	274	259	143	98	343	153	73
December..	305	273	258	144	98	342	153	78
1952								
January...	300	275	258	144	98	347	153	78
February..	289	278	255	146	98	365	153	78
March....	288	277	251	144	98	336	155	78
April.....	290	277	251	142	98	322	157	78
May.....	293	278	252	142	98	306	160	78
June.....	292	278	250	141	98	316	160	69
July.....	295	277	250	141	98	313	160	73
August....	295	278	252	144	98	337	160	73

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] **Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.**

[2] **All potash salts now quoted F.O.B. mines only; manure salts since June 1941, other carriers since June 1947.**

** **The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. The maximum discount is now 16%. Applied to muriate of potash, a price slightly above $.353 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"1952 Fertilizer Recommendations for Arkansas," Ext. Serv., Univ. of Ark., Little Rock, Ark., Cir. 467 (Rev.), Feb. 1952, C. F. Lund, W. H. Freyaldenhoven, and E. J. Allen.

"Fertilizing Materials 1951," Bur. of Chem., Dept. of Agr., Sacramento, Calif., Spec. Pub. No. 244, Mar. 1952.

"Sales of Commercial Fertilizers and of Agricultural Minerals Reported to Date for Quarter Ended June 30, 1952," Bur. of Chem., Dept. of Agr., Sacramento, Calif., No. FM-229, Aug. 13, 1952.

"The Nitrogen Fertilization of Connecticut Tobacco," Agr. Exp. Sta., Univ. of Conn., New Haven, Conn., Bul. 559, June 1952, T. R. Swanback.

"Effect of Minor Elements, Particularly Copper, on Peanuts," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 494, May 1952, H. C. Harris.

"Fertilizer Should Contain a Source of Sulfur for Clover Pastures in Many Areas of Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-35, Aug. 1951, J. R. Neller, G. B. Killinger, D. W. Jones, R. W. Bledsoe, and H. W. Lundy.

"Inspection of Commercial Fertilizers," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Cir. 383, May 1952.

"Nitrogen Materials and Their Use in Indiana," Ext. Serv., Purdue Univ., Lafayette, Ind., Mimeo AY-44a, Rev. June 1952 (1M).

"Fertilizer Analyses—Spring 1952," State Board of Agr., Topeka, Kans., July 23, 1952.

"Fertilizer Recommendations for Louisiana, 1952," Agr. Exp. Sta., La. State Univ., Baton Rouge, La.

"Fertilizer, Liming and Seeding Practices for Processing Peas in Maine," Agr. Exp. Sta., Univ. of Me., Orono, Me., Bul. 496, Mar. 1952, H. J. Murphy and G. L. Terman.

"Results of Fertilizer Experiments with Sorgo Grown for Sirup in Mississippi 1942-1949," Agr. Exp. Sta., Miss. State College, State College, Miss., Cir. 167, Dec. 1951, E. S. Lyons, I. E. Stokes, J. F. O'Kelly, and S. P. Crockett.

"Fertilizer Inspection and Analysis: Fall, 1951," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 585, July 1952.

"Fertilization and Improvement of Native Subirrigated Meadows in Nebraska," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Cir. 92, Apr. 1952, P. Ehlers, G. Viehmeyer, R. Ramig, and E. M. Brouse.

"Fertilizers and Limes—1951," Agr. Exp. Sta., Rutgers Univ., New Brunswick, N. J., Insp. Series 45, Mar. 1952, S. B. Randle.

"Liquid Nitrogen Fertilizer," Ext. Serv., N. C. State College, Raleigh, N. C., Cir. 369, May 1952, E. R. Collins.

"North Carolina Fertilizer and Fertilizer Materials Tonnage Report for the Fiscal Year 1951-52 through June," Dept. of Agr., Raleigh, N. C., July 28, 1952.

"Fertilizer Sales by Grades in Order of Tonnage, January 1, 1952-June 30, 1952," Dept. of Agr., Raleigh, N. C.

"South Carolina Fertilizer and Fertilizer Materials Tonnage Report July 1951-June 1952," Clemson College, Clemson, S. C., Aug. 16, 1952.

"Influence of Fertilizers and Lime Applied to Rice in 1949 on Pasture Production in 1950 and 1951," Agr. Exp. Sta., Tex. A & M College, College Station, Tex., P. R. 1443, Mar. 1, 1952, R. M. Weihing, R. H. Wyche, and R. L. Cheaney.

"Effect of Fertilizers on the Yield of Corn at Nacogdoches, 1951," Agr. Exp. Sta., Tex. A & M College, College Station, Tex., Mar. 26, 1952, H. C. Hutson and F. L. Fisher.

"Control of Zinc Deficiency in Field Beans with Zinc Sulphate Sprays," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Sta. Cir. No. 143 (Rev.), Mar. 1952, F. G. Viets, Jr.

"The 'Dynamite' Phosphate Method of Fertilizing Strawberry Plants," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Sta. Cir. No. 177, Dec. 1951, F. T. Tremblay, K. E. Baur, M. W. Carstens, and D. F. Allmendinger.

Soils

"Know California's Land—A Land-Capability Guide for Soil and Water Conservation," Dept. of Natural Resources, Sacramento, Calif.,

Feb. 1952, L. R. Wohletz and E. F. Dolder.

"Summary of Records from 120 Farms on Slowly Permeable Soils in Northeastern Illinois, 1950," Dept. of Agr. Econ., Univ. of Ill., Urbana, Ill., AE2808, June 28, 1951, W. H. Heneberry, E. L. Sauer, and H. C. M. Case.

"Bolivar County Soils," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 489, Mar. 1952, G. E. Rogers and H. B. Vanderford.

"Some Soil and Crop Facts," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., P. R. 20, May 1952.

"Summary of Soils and Crops Experiments," Ext. Serv., Univ. of Mo., Columbia, Mo.

"The Improvement of an Alkali Soil by Treatment with Manure and Chemical Amendments, Owyhee Irrigation Project, Oregon," Oreg. State College, Corvallis, Oreg., Sta. Tech. Bul. 22, Dec. 1951, C. A. Bower, L. R. Swarner, A. W. Marsh, and F. M. Tileston.

"Soil and Water Conservation and Use in Oregon," Ext. Serv., Oreg. State College, Corvallis, Oreg., Ext. Bul. 725, Mar. 1952.

"How to Improve your Garden Soil," Ext. Serv., Univ. of Vt., Burlington, Vt., Brieflet 878, PR 352, E. P. Hume.

"Soil Survey: York County Maine," USDA, Wash., D. C., Series 1939, No. 11, Feb. 1952, K. V. Goodman, D. B. Lovejoy, and J. R. Arno.

"Soil Survey: Okfuskee County Oklahoma," USDA, Wash., D. C., Series 1940, No. 7, Apr. 1952, W. H. Buckhannan, V. A. Bogard, H. H. Bush, A. D. Carson, E. O. Graham, W. A. Sparwasser, and G. O. Walker.

"Soil Survey of the Shoshone Area, Wyoming," USDA, Wash., D. C., Series 1927, No. 38, T. J. Dunnewald, C. Pearson, J. Thorp, E. J. Carpenter, and E. G. Fitzpatrick.

"Wood Chips for the Land," Soil Conser. Serv., USDA, Wash., D. C., Leaf, No. 323, A. C. McIntyre.

Crops

"Seed Production of Ladino Clover," Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 182, Nov. 1951, M. D. Miller, V. P. Osterli, L. G. Jones, and A. D. Reed.

"Citrus Fruit for the Home Orchard," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 409, Apr. 1952, J. C. Johnston.

"Progress Report 1937-1947, Dominion Experimental Station Fredericton, N. B." Dom. Exp. Sta., Fredericton, N. B., Can., Oct. 1949.

"A Review of Experimental Work at the Dominion Experimental Station Saanichton, B. C. 1950," Dom. Exp. Sta., Saanichton, B. C., Can., Mimeo. 115, July 1950.

"Agricultural Experiment Stations Annual Report for the Fiscal Year Ending June 30, 1951," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla.

"Hibiscus in Florida," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 467 Rev., May 1952, R. D. Dickey.

"Dooryard Citrus Plantings in Florida," Ext. Serv., Univ. of Fla., Gainesville, Fla., Bul. 140, May 1952, J. A. Granger, Revised by A. F. Camp.

"Floranna Sweet Clover and Its Culture," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-46, Feb. 1952, G. B. Killinger and G. E. Ritchey.

"The Tropical Black Raspberry," Sub-Tropical Exp. Sta., Univ. of Fla., Homestead, Fla., Mimeo. Rpt. No. 16, Jan. 1952, R. B. Ledin.

"Serving Georgia Through Research," Agr. Exp. Sta., Univ. of Ga., Experiment, Ga., 1951 A. R.

"New Findings for Farm Folk—A Report of the Iowa Agricultural Experiment Station for the Two Years July 1, 1949 to June 30, 1951," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Part I.

"Kansas Corn Tests 1951," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Bul. 352, Feb. 1952, A. L. Clapp and L. A. Tatum.

"Ponca Winter Wheat," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Bul. 354, May 1952.

"Seed Production in Louisiana," Ext. Serv., La. State Univ., Baton Rouge, La., Ext. Pub. 1094, Oct. 1951, R. A. Wasson.

"Grassland Farming in Louisiana," Ext. Serv., La. State Univ., Baton Rouge, La., Ext. Pub. 1102, Oct. 1951, R. A. Wasson.

"Massachusetts Agricultural Experiment Station Annual Report for the Fiscal Year Ending June 30, 1951," Agr. Exp. Sta., Univ. of Mass., Amherst, Mass., Bul. No. 466, Sept. 1951.

"The Home Fruit Planting," Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Bul. 255, May 1952, L. C. Snyder.

"Raspberries for Minnesota," Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Fldr. 163, Mar. 1952, L. C. Snyder.

"Summer Care of Vegetable Gardens," Ext. Serv., Univ. of Minn., St. Paul, Minn., Ext. Fldr. 167, July 1952, O. C. Turnquist.

"Ryegrass," Ext. Serv., Miss. State College, State College, Miss., Ext. Pub. 199 (15M), Aug. 1951, W. R. Thompson.

"Pasture Management," Ext. Serv., Miss. State College, State College, Miss., Ext. Pub. 233 (10M), June 1952, W. R. Thompson.

"Annual Report of the Director of the New Hampshire Agricultural Experiment Station," Agr. Exp. Sta., Univ. of N. H., Durham, N. H., Sta. Bul. 382, Dec. 1949.

"The Iris Garden," Ext. Serv., Rutgers Univ., New Brunswick, N. J., Leaf. 81, May 1952, C. H. Connors.

"Seventieth Annual Report—New York State Agricultural Experiment Station, Geneva, New York," Agr. Exp. Sta., Cornell Univ., Geneva, N. Y., 1951.

"Improved Field Crop Varieties, 1952," Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul.

858, Apr. 1952.

"Hay and Pasture Seedings for '52," Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul. 781, Rev. Mar. 1952, L. Saltonstall, Jr.

"Effect of Tree Barriers on Outcrossing in Corn," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Tech. Bul. No. T-45, Aug. 1952, M. D. Jones and J. S. Brooks.

"The Annual Lespedezas," Forage Crops Leaf. No. 9, May 1952, W. C. Elder; "Lawns for Town and Country," Forage Crops Leaf. No. 10, May 1952, R. A. Chessmore; "King Ranch Bluestem," Forage Crops Leaf. No. 11, May 1952, J. R. Harlan; "Dallis Grass," Forage Crops Leaf. No. 12, May 1952, W. C. Elder; Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla.

"The Southeastern Soil Improvement Station, Heavener, Summary of Results Field Day June 6, 1952," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Mimeo. Cir. M-235, June 1952.

"Vegetable Seed Production in Oregon," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Sta. Bul. 512, Apr. 1952, H. L. Schudel.

"Hybrid Field Corn Variety Trials in Oregon 1950 and 1951," Agr. Exp. Sta., Oreg. State College, Corvallis, Oreg., Cir. of Inf. 509, Apr. 1952, R. E. Fore, E. N. Hoffman, C. A. Larson, H. H. White and J. T. McDermid.

"Cherry Production," Ext. Serv., Pa. State College, State College, Pa., Cir. 403, May 1952, J. U. Ruef.

"Planting Forest Trees in Pennsylvania," Ext. Serv., Pa. State College, State College, Pa., Cir. 404, May 1952, W. W. Simonds.

"Vegetable Variety Trials—1951," Agr. Exp. Sta., Pa. State College, State College, Pa., P. R. No. 67, Mar. 1952, M. L. Odland and C. J. Noll.

"Agronomy Handbook for South Carolina," Ext. Agronomy Div., Clemson College, Clemson, S. C., Bul. 104, Apr. 1952.

"Sericea and Other Perennial Lespedezas," Ext. Serv., Clemson College, Clemson, S. C., Cir. 369, Feb. 1952, H. A. Woodle.

"South Dakota Corn Performance 1951 Tests" Agr. Exp. Sta., S. D. State College, Brookings, S. D., G. E. Nachtigal and D. B. Shank.

"Annual Report 1951," Ext. Serv., Tex. A & M College, College Station, Tex., Apr. 1952.

"The Home Lawn . . . Good Turf for Utility and Beauty," Agr. Exp. Sta., Tex. A & M College, College Station, Tex., Bul. 747, June 1952, J. R. Watson, Jr. and A. W. Crain.

"Desirable Grasses Increase after Post Oak Control," Agr. Exp. Sta., Tex. A & M College, College Station, Tex., P. R. 1448, Mar. 15, 1952, V. A. Young.

"Range Management Studies on the Ranch Experiment Station," Agr. Exp. Sta., Tex. A & M College, College Station, Tex., P. R. 1449, Mar. 15, 1952, L. B. Merrill and V. A. Young.

"Performance and Establishment of Warm Season Grasses at Kirbyville 1951," Agr. Exp. Sta., Tex. A & M College, College Station, Tex., P. R. 1451, Mar. 22, 1952, E. D. Cook and R. P. Bates.

"Pasture Management," Ext. Serv., State College of Wash., Pullman, Wash., Bul. No. 435 (Rev.), July 1952, L. Chapman, A. G. Law, K. J. Morrison.

"Growing Peaches," Ext. Serv., State College of Wash., Pullman, Wash., Bul. No. 462, June 1952, J. C. Snyder, D. H. Brannon, and M. R. Harris.

"Oats," Ext. Serv., Univ. of Wis., Madison, Wis., Cir. 413, Mar. 1952, H. L. Shands and D. C. Arny.

"Report of the Secretary of Agriculture 1951," USDA, Wash., D. C.

"Reseeding to Increase the Yield of Montana Range Lands," USDA, Wash., D. C., Farmers' Bul. No. 1924, Rev. May 1952, L. R. Short and E. J. Woolfolk.

"Commercial Growing of Sweet Corn," USDA, Wash., D. C., Farmers' Bul. No. 2042, July 1952, V. R. Boswell.

"Rice Production in the Southern States," USDA, Wash., D. C., Farmers' Bul. No. 2043, July 1952, J. W. Jones, J. O. Dockins, R. K. Walker, and W. C. Davis.

"Natob—A New Bush Lespedeza for Soil Conservation," USDA, Wash., D. C., Cir. No. 900, Mar. 1952, F. J. Crider.

Economics

"Lemons and Lemon Products Changing Economic Relationships, 1951-52," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Bul. 729, S. Hoos and R. E. Seltzer.

"Statistical Supplement to Agricultural Experiment Station Bulletin 729 Lemons and Lemon Products Economic Status, 1951," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Oct. 1951, S. Hoos and R. E. Seltzer.

"Analysis of Productive Capacity of Illinois Agriculture—Production Attainable for 1955," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., AE2833, Oct. 1951.

"Indiana Crops and Livestock—Annual Crop Summary 1951," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., No. 315, Dec. 1951.

"Farm Management Summary and Analysis the 1950 Report by Type of Farming Area," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Agr. Econ. Rpt. No. 47.

"An Appraisal of Kansas Agricultural Productive Capacity, 1955," Agr. Exp. Sta., Manhattan, Kans., Agr. Econ. Rpt. No. 50, Contribution No. 173, Nov. 1951.

"Statistics of Farmers' Cooperatives in Minnesota, 1950," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Bul. 412, June 1952, E. F. Koller, T. W. Manning and O. B. Jesness.

"Commercial Family-Operated Sheep Ranches, Range Livestock Area, Northern

Great Plains 1930-50, Organization, Production Practices, Costs and Returns," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Bul. 478, Nov. 1951, J. R. Gray and C. B. Baker.

"Montana Cooperative State Grazing Districts in Action," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Bul. 481, Dec. 1951, L. S. Thompson.

"Acceptance of Improved Farm Practices in Three Coastal Plain Counties," Agr. Exp. Sta., N. C. State College, Raleigh, N. C., Tech. Bul. No. 98, May 1952, E. A. Wilkening.

"Rental Arrangements in the Coastal Plain," Ext. Serv., N. C. State College, Raleigh, N. C., Cir. No. 370, Aug. 1952, C. B. Ratchford.

"Agricultural Productive Capacity—Utah-1955," Agr. Exp. Sta., Utah State College, Logan, Utah, Mimeo. Series 379, Nov. 1951.

"A Square Look at Spokane County," Ext. Serv., State College of Wash., Pullman, Wash., Bul. No. 463, June 1952, L. Scantland, C. A. Svinth, and M. J. Taves.

"Cost of Producing Apples in Orchard Areas of Washington," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Cir. No. 185, Mar. 1952, J. P. Swanson and L. E. Cairns.

"Agriculture's Capacity to Produce, Possibilities Under Specified Conditions," Bur. of Agr. Econ., USDA, Wash., D. C., Agr. Inf. Bul. No. 88, June 1952.

"Cotton Farming in the Southern Piedmont 1930-51, Organization, Costs, and Returns," Bur. of Agr. Econ., USDA, Wash., D. C., Agr. Inf. Bul., No. 89, June, 1952.

"Tree Nuts—Production, Farm Disposition, Value, and Utilization of Sales 1944-51," Bur. of Agr. Econ., USDA., Wash., D. C., Aug. 1952.

The Nutrition of Muck Crops . . .

(*From page* 11)

ground growth of celery and spinach, of cabbage heads, and potato tubers, and in pounds of peppermint oil. Eight per cent of phosphate was applied uniformly in all mixtures. Application of the phosphate-potash mixtures was at 1,000 pounds per acre annually for all crops except potatoes and peppermint which received 600 pounds. Nitrogen was sidedressed during growth as needed. Celery, onions, and spinach generally required it and cabbage and table beets in wet years. It is interesting to note that all crops except onions and peppermint showed increase in yield with increase in percentage of potash applied. Cabbage yields increased up to the 24% potash application and did not change with 32% in the mixture.

Position of Fertilizer. For most crops on muck soils, it is advisable to drill the fertilizer into the ground and not disturb it further by disking, rather than to apply it on the surface and disk it in. For a number of crops, application in the row, about 2 inches directly below the seed, is likely to give the highest yields, generally with less fertilizer needed than if it were broadcast. Onions are probably most responsive to row fertilization on muck, with table and sugar beets, carrots, corn, and parsnips also benefiting. Cabbage and cauliflower seed are very susceptible to fertilizer injury but the transplants will show marked benefit from fertilization 4 to 5 inches deep in the row. Potatoes on muck will give slightly better yields with fertilizer sidedressed at planting rather than broadcast. Celery and spinach are greatly benefited by sidedressing during growth, especially with a mixture high in nitrogen or a straight nitrogen fertilizer.

The Proper Analysis. In Table VII are given the analyses recommended for various crops under conditions of fair and good drainage. Where drainage is poor, it is advisable to improve it to some extent before attempting to raise and fertilize most crops. No fertilizer recommendations are made for asparagus and alfalfa with fair drainage because good drainage is advisable for those crops. No recommendation is made for reed canary grass with good drainage as that crop is better adapted to poorly drained soils.

(*To be continued next issue*)

TABLE VII.—FERTILIZER ANALYSES AND RATES OF APPLICATION FOR CROPS ON MUCK SOIL

TABLE VII.—FERTILIZER ANALYSES AND RATES OF APPLICATION FOR CROPS ON MUCK SOIL, TOGETHER WITH INITIAL PERCENTAGES OF MINOR ELEMENT PLANT FOODS RECOMMENDED IN THE FERTILIZER MIXTURE

For acid muck soils, (pH 6.5 or less)					Crop and rate of annual fertilization. (For crops fertilized in row, not more than ½ to ¾ the amounts given below should be used, preferably 2 to 3 inches directly below seed.)		For alkaline and faintly acid muck soils, (pH 6.6 or more)				
Fertilizer analyses for mucks of good and fair drainage. % minor element salts in fertilizer for initial application. (Actual percentage of element in parentheses)							Fertilizer analyses for mucks of good and fair drainage. % minor element salts in fertilizer for initial application. (Actual percentage of element in parentheses)[3]				
Salt, lbs. per acre	% in fertilizer		Fertilizer analysis				Fertilizer analysis		% in fertilizer		Salt, lbs. per acre
	Borax	Copper sulfate	Fair drainage	Good drainage	CROP[1]	Pounds[2] per acre	Good drainage	Fair drainage	Manganese sulfate	Borax	
0	0	0	—	0–10–30	Asparagus	600–1000	0–10–30	—	5–10 (1.25–2.5)	0	0
0	0	0	0–12–12	0–20–20	Beans	500–800	0–20–20	3–12–12	10–20 (2.5–5)	0	0
0	0–2.5 (0–0.3)	2.5 (0.63)	3– 9–18	0–10–30	Broccoli	500–1000	0–10–20	3– 9–18	5–10 (1.25–2.5)	2.5–5 (0.3–0.6)	0
100–200	0–2.5 (0–0.3)	5 (1.25)	3– 9–18	0–10–30	Cabbage, and Kale, Kohlrabi	600–1000	0–10–30	3– 9–18	5 (1.25)	2.5–5 (0.3–0.6)	100–200
0	0	5 (1.25)	0–10–30	0–10–30	Carrots	800–1200	0–10–30	3– 9–18	5–10 (1.25–2.5)	0	0
0	2.5 (0–0.3)	2.5 (0.63)	3– 9–18	0–10–30	Cauliflower	1200–1600	0–10–30	3– 9–18	5–10 (1.25–2.5)	2.5–5 (0.3–0.6)	0
250–750	2.5 (0.3)	0	3–12–12	3– 9–18	Celery (Early)	1800–2500	3– 9–18	5–10–10	5–10 (1.25–2.5)	2.5–5 (0.3–0.6)	250–500
250–750	2.5 (0.3)	0	3– 9–18	0–10–30	Celery (Late)	1500–2000	0–10–30	3– 9–18	5–10 (1.25–2.5)	2.5–5 (0.3–0.6)	250–500
0	0	2.5 (0.63)	3– 9–18	0–10–30	Cucumbers	500–1000	0–10–30	3– 9–18	5–10 (1.25–2.5)	0	0
0	2.5–5 (0.3–0.6)	5–10 (1.25–2.5)	5–10–10	3– 9–18	Head lettuce[4]	0–1800	3– 9–18	5–10–10	10–20 (2.5–5)	2.5–5 (0.3–0.6)	0

Salt, lbs. per acre	For acid muck soils, (pH 6.5 or less)				Crop and rate of annual fertilization. (For crops fertilized in row, not more than ½ to ¾ the amounts given below should be used, preferably 2 to 3 inches directly below seed.)		For alkaline and faintly acid muck soils, (pH 6.6 or more)				Salt, lbs. per acre
	Fertilizer analyses for mucks of good and fair drainage. % minor element salts in fertilizer for initial application. (Actual percentage of element in parentheses)						Fertilizer analyses for mucks of good and fair drainage. % minor element salts in fertilizer for initial application. (Actual percentage of element in parentheses)[3]				
	% in fertilizer		Fertilizer analysis				Fertilizer analysis		% in fertilizer		
	Borax	Copper sulfate	Fair drainage	Good drainage	CROP[1]	Pounds[2] per acre	Good drainage	Fair drainage	Manganese sulfate	Borax	
0	2.5–5 (0.3–0.6)	10 (2.5)	5–10–10	3– 9–18	Leaf lettuce[4] Spinach[4] Endive[4]	600–1200	3– 9–18	5–10–10	10–20 (2.5–5)	2.5–5 (0.3–0.6)	0
0	0	2.5–5 (0.63–1.25)	3–12–12	0–10–20	Peppermint	400–800	3–12–12	3–18– 9	0	0	0
			3–18– 9	0–12–12	Spearmint	400–800	3–12–12	3–18– 9	10–20 (2.5–5)	0	0
0	0	5 (1.25)	3–12–12	3– 9–18	Onions[4 5]	1000–1800	3– 9–18	3–12–12	5–10 (1.25–2.5)	0	0
			3–18– 9	0–12–12			0–12–12	3–18– 9			
0	2.5 (0.3)	2.5–5 (0.63–1.25)	0–10–20	0–10–30	Parsnips	800–1200	0–10–30	0–10–20	5–10 (1.25–2.5)	5 (0.6)	0
100–200	0	2.5 (0.63)	3– 9–18	0–10–30	Peas	600–1000	0–10–30	3– 9–18	10 (2.5)	0	100–200
0	0–2.5 (0–0.3)	2.5 (0.63)	0–10–20	0–10–30	Potatoes	800–1200	0–10–30	0–10–20	10 (2.5)	0–5 (0–0.6)	0
0	0	2.5 (0.63)	0–10–20	0–10–30	Pumpkins, squash	300–600	0–10–30	0–10–20	10–20 (2.5–5)	0	0
100–200	2.5 (0.3)	5 (1.25)	3– 9–18	0–10–30	Radishes	400–700	0–10–30	3– 9–18	10 (2.5)	5 (0.6)	0
0	2.5 (0.3)	5 (1.25)	0–10–20	0–10–30	Rutabagas	300–600	0–10–30	0–10–20	5–10 (1.25–2.5)	2.5–5 (0.3–0.6)	0
0	2.5 (0.3)	2.5 (0.63)	3– 9–18	0–10–20	Sweet Corn	600–1000	0–10–20	3– 9–18	5–10 (1.25–2.5)	5 (0.6)	0
500–1000	2.5	2.5–5	3– 9–18	0–10–30	Table beets	600–1200	0–10–30	3– 9–18	5–10	2.5–5	500–1000

500–1000	2.5 (0.3)	2.5–5 (0.63–1.25)	3– 9–18	0–10–30	Table beets, swiss chard	600–1200	0–10–30	3– 9–18	5–10 (1.25–2.5)	2.5–5 (0.3–0.6)	500–1000
0	0	5 (1.25)	3– 9–18	0–10–20	Tomatoes	800–1000	0–20–20	3–12–12	5–10 (1.25–2.5)	0	0
500	2.5 (0.3)	5 (1.25)	0–10–20	0–10–30	Turnips	300–600	0–10–30	0–10–20	5–10 (1.25–2.5)	2.5–5 (0.3–0.6)	500
0	2.5–5 (0.3–0.6)	5–10 (1.25–2.5)	—	0–10–30	Alfalfa [4]	400–600	0–10–30	—	5–10 (1.25–2.5)	5 (0.6)	0
0	2.5–5 (0.3–0.6)	2.5 (0.63)	3– 9–18	0–10–30	Corn, field	400–800	0–10–30	3– 9–18	5–10 (1.25–2.5)	2.5–5 (0.3–0.6)	0
0	0	5 (1.25)	0–12–12	0–10–30	Barley, oats, rye	250–500	0–10–30	—	10–20 (2.5–5)	0	0
500–1000	2.5 (0.3)	2.5–5 (0.63–1.25)	3– 9–18	0–10–30	Sugar beets, mangels	400–700	0–10–30	3– 9–18	0–10 (0–2.5)	2.5–5 (0.3–0.6)	500–1000
0	0–2.5 (0–0.3)	5 (1.25)	0–10–30	0–10–30	Permanent pasture	200–300	0–10–30	3– 9–18	10–20 (2.5–5)	2.5 (0.3)	0
0	0	5 (1.25)	3– 9–18	0–10–30	Timothy, and alsike, brome grass	250–400	0–10–30	3– 9–18	10 (2.5)	0	0
0	0	2.5–5 (0.63–1.25)	3– 9–18 10–10–10	—	Reed canary grass	300–500	—	3– 9–18 10–10–10	10–20 (2.5–5)	0	0
0	0	2.5–5 (0.63–1.25)	0–10–20	0–10–30	Soybeans, ladino, and sweet clover	250–400	0–10–30	0–10–20	10–20 (2.5–5)	0	0
0	0	5–10 (1.25–2.5)	3– 9–18	0–10–30	Sudan grass millet [4]	250–400	0–10–30	3– 9–18	10–20 (2.5–5)	0	0
100–200	0	10–20 (2.5–5)	0–10–20	0–10–30	Wheat [4] Dill [4]	300–500	0–10–30	—	10–20 (2.5–5)	0	100–200
0	0	2.5–5 (0.63–1.25)	3– 9–18	0–10–30	Raspberries	500–800	0–10–30	3– 9–18	10–20 (2.5–5)	0	0
0	0	5 (1.25)	0–12–12	0–12–12	Strawberries	300–500	0–12–12	0–12–12	0–10 (0–2.5)	0	0

[1] Where two crops are produced on the same field in one growing season, the maximum fertilization for the year should not be more than the maximum recommended for the first crop plus two-thirds of the maximum recommended for the second crop. Where a crop requiring light fertilization, such as mint, follows a crop which received heavy fertilization, such as celery or onions, the rate of fertilization for the crop of the second year can be considerably reduced below that recommended above.

[2] Sidedressings of ammonium nitrate may be required during growth on the following crops: Broccoli, cabbage, cauliflower, corn, 100 to 150 pounds per acre; celery, 150 to 400 pounds. Topdressings of available nitrogen following exceptionally wet weather may be required on the following crops: Lettuce, mint, onions, radishes, spinach, table beets, swiss chard, 100 to 200 pounds per acre; double the application if nitrate of soda is used.

[3] Where a range in percentage of minor plant-food elements is given, the percentage which should be used depends on the rate of application of fertilizer and on the degree of acidity or alkalinity of the soil. Zinc sulfate or borax generally not advisable in row fertilization. The more alkaline the muck soil and the deeper the alkalinity extends, the larger the percentages of manganese sulfate and of borax that are likely to be required for the crops which are benefited by them.

[4] These crops are likely to benefit from applied copper sulfate even when the soil is alkaline.

[5] For onions 2½% zinc sulfate is recommended in the fertilizer mixture on new muck for the first three years of cropping. Need greater in wet seasons or on wet mucks.

Fertilizing Corn for . . .

(*From page 26*)

TABLE I.—CORN GRAIN YIELD, PROTEIN AND OIL CONTENT OF A CROP GROWN ON THE FLAT GRAY LAND OF SOUTHERN ILLINOIS DIETERICH FIELD—1951.

Soil treatment	Grain Bu A	Protein		Oil	
		%	lbs.	%	lbs.
Lime	19	10.4	110	4.15	44
L 3–12–12	66	10.6	392	4.96	183
LN	35	10.1	198	4.00	78
LK	60	8.0	269	4.45	149
LKN 3–12–12	92	10.1	520	5.00	257

L—limestone, 3 tons per acre.
N—ammonium nitrate, 190 lbs. sidedressed.
K—muriate of potash, 300 lbs. broadcast before planting.
3-12-12—starter fertilizer 200 lbs. in bands at planting.

oil content of the grain. This land was in red clover in 1950 with the hay removed. The corn was drilled and the stand established at about 9,000 plants per acre. Where the land had only lime (L) and legume residue plowed under the corn yield was 19 bushels an acre. The grain yield was 92 bushels where the treatment was made up of 300 lbs. of muriate of potash (60%), 190 lbs. of ammonium nitrate, and 200 lbs. of 3-12-12 fertilizer. The yields on the treatments in between these two extremes never reached a very high mark because the fertilization was either not balanced or was insufficient in quantity. The 92-bushel yield of corn is in keeping with the production on land which is being farmed at a profit in the Illinois cornbelt.

The percentage protein in the corn grain on this Dieterich Field was at a satisfactory level except where there was a relatively high yield of 60 bushels with no additional nitrogen. With the low yield of 19 bushels there was apparently sufficient nitrogen supplied by the legume residue to give a protein content of 10.4%. Where the grain yield advanced to 60 bushels an acre with no additional nitrogen (LK), the protein content dropped off to 8%. Where the corn was heavily fertilized, the yield advanced to 92 bushels and the protein content held up to 10.1%.

Oil content is also a quality factor in corn grain. The per cent oil in the grain increased where muriate of potash (K) was added to the soil. Where there was no potash treatment, the oil content ranged from 4.0 up to 4.15%. With muriate of potash added, the per cent oil ranged from 4.45 to 5.0% in this field test.

An extensive study of corn roots in Illinois had been under way for about three years and the value of these results seems to justify the extra effort necessary to get this sort of data. Some work done by Professor J. B. Fehrenbacher on the Toledo Field (1951) in southern Illinois established the fact that corn roots penetrate this Cisne silt loam subsoil to a depth of 55 inches. It was

TABLE II.—CORNSTALKS AND ROOTS—TOTAL NITROGEN, PHOSPHORUS, AND POTASSIUM—DIETERICH FIELD—1951.

Soil treatment	Part of plant	Per cent		
		N	P	K
Lime	Stalks	.53	.30	.35
	Roots	.82	.04	.41
Lime 3–12–12	Stalks	.81	.18	.40
	Roots	.63	.05	.46
LN	Stalks	.97	.04	.35
	Roots	.63	.06	.29
LK	Stalks	.61	.21	1.23
	Roots	.55	.10	1.22
LKN 3–12–12	Stalks	.72	.14	1.09
	Roots	.55	.10	.97

Fig. 2 Corn roots and ears from the Dieterich Field, September 18, 1951. On left corn treated with limestone, yield 19 bushels. On right corn was treated with lime and ammonium nitrate 190 lbs. per acre, yield 35 bushels.

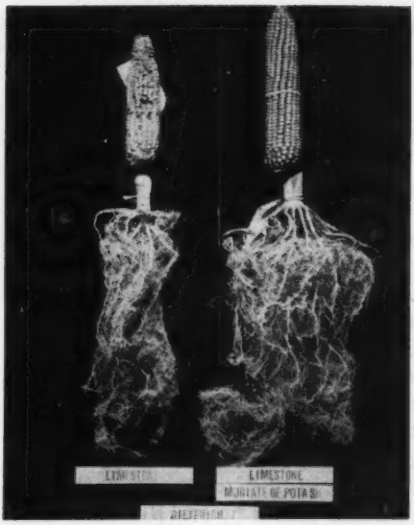


Fig. 3. Corn roots and ears from the Dieterich Field, September 18, 1951. On left treated with limestone, yield 19 bushels per acre. On right treated with limestone and 300 lbs. muriate of potash, yield 60 bushels per acre.

calculated that the total root growth was approximately 4,030 lbs. an acre on the dry basis. It was found that 85% of the roots were in the top 9 inches. The top-growth stalks, grain, and cobs amounted to 13,770 lbs. dry matter or a total of 17,800 lbs. an acre including the roots. The grain yield was 118 bushels an acre on this land treated with lime, legumes, rock phosphate, and potash. The corn was one of the cytosterile hybrids (G91) which made a vigorous growth and a high yield on this flat gray soil.

Figures 1, 2, and 3 show corn roots removed to a depth of 9 inches. It was reasoned that if 85% of the corn roots were in the top 9 inches, this portion could be readily removed for comparisons and for chemical analysis. This method of lifting and preserving the natural position of roots is being extended to studies on other crops.

The analytical results shown in Table II indicate that corn roots at maturity of the crop have about the same nitrogen, phosphorus, and potassium content as the cornstalks. Percentages of these elements in the roots were affected by the treatment of the soil.

Evaluation of . . .

(*From page* 22)

to return 4 per cent which also is reinvested the compounding of the annual values and interest will amount to nearly $30,000 in 35 years. This is approximately the length of time that many farmers expect to continue in active operation of any particular farm. This may sound fantastic but apparently the potash that continually becomes available can go a long way toward paying for the land itself. However, in actual practice this value

often is very much reduced by loss of potash in handling manure. It can be reduced by buying more potash than is necessary although where grassland culture is emphasized the profit more likely is held down by the purchase of too little potash.

This brings us to the problem as to what evaluation farmers can make of their fertility systems that will supplement laboratory tests and give them added assurance that they are not placing too much confidence in the soil as a source of potash. A formula that is rather easily followed is illustrated in Tables III and IV. The computation provides a fairly accurate measure of the return of phosphoric acid and potash by any particular combination of manure, fertilizer, and residues. For purpose of illustration a 4-year rotation is chosen with high yields, viz., corn, 80 bushels; wheat, 40 bushels; first-year hay, 3 tons; and second-year hay, 4 tons per acre. As computed from Table I this combination of crops and yields contains 128 pounds of phosphoric acid and 420 pounds of potash. Dividing these by 4 gives annual acre averages of 32 and 105 respectively for phosphoric acid and potash. Dropping out a year of hay to make a 3-year rotation or adding another year of meadow to make one of 5 years does not alter the average very much for phosphoric acid but it does change the average for potash quite materially.

On the basis of applying from 1 to 2 times as much phosphoric acid as the crops contain, the standard selected could be anywhere between 30 and 60 pounds per acre per year. Many farmers, at least for a few years, could approach the higher standard with benefit both to the soil and to their pocketbook. On the potash side the problem is complicated by the variable figures ranging from 38 to 110 which represent the amount of potash that reasonably can be counted on as a contribution from the soil.

Table III illustrates a treatment that at first glance might appear to be fairly good. The two grain crops each get 300 pounds of fertilizer per acre and 8 loads or 6 tons of manure are applied for corn. But when evaluated by the formula the treatment fails to approach a reasonable standard. Less phosphoric acid is applied than the crops consume and the drain on the soil for potash is more than any but the high release soils can stand. Soil cannot be built up by such meager treatment; rather there is likely to be a lowering of the available supplies of

TABLE III.—AN EXAMPLE OF INADEQUATE TREATMENT

Crop and treatment C.W.H.H. rotation	Return per acre	
	Phosphoric acid	Potash
	lbs.	lbs.
Corn, 6 tons manure	24	60
300 lbs. 2–12–6	36	18
Wheat, 300 lbs. 2–12–6	36	18
Meadow(1) None	.....	.....
Meadow(2) None	.....	.....
Total return during 4 years	96	96
Average annual return	24	24
Annual average in large yields	32	105
Annual acre balance	−8	−81

TABLE IV.—AN EXAMPLE OF MORE ADEQUATE TREATMENT

Crop and treatment C.W.H.H. rotation	Return per acre	
	Phosphoric acid	Potash
	lbs.	lbs.
Corn, 6 tons manure	24	60
300 lbs. 3–18–9	54	27
Wheat, cornstalks worked down	6	60
300 lbs. 3–18–9	54	27
Meadow(1), 6 tons manure	24	60
Meadow(2), 200 lbs. 0–10–30	20	60
Total return during 4 years	186	294
Average annual return	47	74
Annual average in large yields	32	105
Annual acre balance	+15	−31

phosphoric acid and potash which in the course of 10 or 15 years will be reflected in the quantity and quality of the meadows, particularly the second-year meadows.

By contrast the soil treatments illustrated in Table IV give a reasonable assurance that future meadows and grain crops will be the equal of, or superior to, current crops. The return of phosphoric acid is 50 per cent in excess of the amount used by the crops and the drain on the soil for potash is such that it can be met by most Ohio soils. In fact, on some Ohio soils the return might be even less without any harmful effects. The difference between the two treatments is due to a more conscientious saving of manure, the use of higher analysis fertilizers, the return of cornstalks as now is commonly done, and fertilization of the meadow—nothing particularly radical but just a good all-round system. The cornstalks may require some commercial nitrogen but that problem is not a part of this discussion.

In this illustration of a better system, manure and crop residues account for 60 per cent of the potash returned. On many farms these always will be the chief sources of potash. Disregard of this relationship is likely to lead to meadow deterioration or to increased purchase of potash in fertilizer bags. At the present time an increasing number of pictures are appearing in farm magazines which portray the self-feeding silo or self-feeding barn as a means of saving labor in the utilization of meadow crops. Labor efficiency is a laudable aim but one has to wonder whether grassland culture will be as popular on these farms 10 years from now as it is in its initial phase. These self-feeding structures often—perhaps usually is a better word—stand out in the open with very little or no protection for the manure that is dropped in the surrounding open yard. Even the pen stabling of dairy cows which started entirely under cover now tends to extend partly outdoors where an uncovered concrete feeding area can be kept clean by frequently pushing the manure to one side. In some cases this is popular because it saves bedding. It is not the purpose here to question the value of these labor-saving practices but rather to point out that they tend to bring into partnership a very efficient method of taking potash out of the soil by growing meadow crops and a very efficient method of losing potash by dropping the manure in open yards. Here in Ohio a steady and continued

depletion of potash affects the meadow crops adversely before it does the grain crops. In particular does it affect meadows after the first year. Corn and small grain needs may be satisfied by relatively small amounts of potash in the fertilizers applied to these crops but the holdover effects of these minor amounts will not guarantee satisfactory meadow yields.

This method of evaluating fertility systems can be used with any rotation by substituting the crops, manure, and fertilizers which fit the program under consideration. Admittedly, the use of such a formula has some objections. Nevertheless, it provides a rather accurate guide which permits any farmer to evaluate his present or proposed practices. It should be combined with laboratory testing which gives information on the status of available phosphoric acid and potash in any soil at any given time. If the amount of either nutrient is low the standards used in this article can be increased; if the amount is high the standards can be decreased, at least temporarily. This combination of testing and computing should enable farmers to evaluate their fertilizer and manure program fairly accurately in the light of present and future needs.

Rescue Grass . . .

(*From page* 18)

of the Conservation farm plans call for this reseeding grass to be used in combination with sericea lespedeza, or reseeding crimson clover.

The Columbiana chapter has a nursery of many new seed crops and a patch of Coastal Bermuda from which they hope to harvest certifiable stolens next year.

Many of the visitors who saw this seed plot questioned the use of so much fertilizer. These farm boys always come up with the right answer: "Can YOU net over $500 per acre with LOW rates of fertilizer?" This seems to answer all the questions which come up concerning fertilizer usage. A further experiment is being tried by these boys in producing a second seed crop on the still growing grass sod. The four-acre plot was topdressed during the first week in June with 400 pounds of ammonium nitrate to encourage new growth and with a fair season these boys intended to harvest a second crop of Rescue seed during the latter part of August.

By-products of Research . . .

(*From page* 25)

the high-fertility system of growing corn. The average weight of residues returned to the soil each year in low-fertility treatment of the State College experiment (foreground of Figure 2) was 2,009 pounds of dry matter per acre. With the high-fertility treatment (background of Figure 2) 6,643 pounds of dry residues per acre were returned each year. The difference, amounting to over two tons, dry weight, of organic material per acre per year constitutes an important contribution to the vital organic fraction of the soil.

Fig. 2. View of two treatments in an experiment at State College, Mississippi, photographed June 30, 1949. Plot in foreground received no nitrogen and had 4,000 plants per acre; yield was 21.2 bushels. Plot in background received 120 pounds of nitrogen and had 12,000 plants per acre; yield was 100.4 bushels. Note grass and weeds in foreground; these were shaded out by corn in background.

In addition, the stalks and leaves of the corn plant responded to applications of nitrogen in much the same manner as the grain. With increases in nitrogen applied, the stalks and leaves were found to contain ever higher nitrogen percentages. So in addition to increases in the amount of crop residues, the residues from the high-fertility system had higher nitrogen content than those from the low-fertility system.

To best utilize these residues they should be cut with a stalk-cutter or lightly disced into the soil in the fall. In this way they are left in or on the

TABLE II.—SUMMARY OF ADVANTAGES FOR HIGH-FERTILITY METHOD OF GROWING CORN. EXPERIMENT AT STATE COLLEGE, MISSISSIPPI. 1947-1950.

Item	Treatment	
	N: 0 Plants: 4,000	120 12,000
Yields of corn, bu-acre	29.4	105.5
Incidental advantages:		
Cultivation required	4	3
Protein content of grain, %	8.24	9.98
Annual return of crop residues, lbs/acre	2,009	6,643
Nitrogen in crop residues, lbs/acre	8.6	32.1
Phosphorus in crop residues, lbs/acre	6.8	10.7
Potassium in crop residues, lbs/acre	12.3	26.2

surface to protect the soil from erosion through the winter.

Summary

In summary, both direct and indirect advantages of growing corn by the high-fertility method are itemized in Table II. In the aggregate they are impressive. More corn was produced, which met the main objective of the study. The corn was produced with fewer cultivations. The grain had higher protein content. Return of crop residues was increased to more than threefold. These are some of the by-products of modern corn-growing methods.

The Mineral Uptake . . .

(*From page* 16)

last half of the season. The data support recommendations of high potassium fertilization for the sweet potato, point out the relatively low phosphorus requirement of the crop, and suggest that increased nitrogen applications may be of value under certain conditions.

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Footfalls Forgotten . . .

(*From page* 5)

these you did business in the street, sometimes bargaining and gesturing to meet the common trading ground.

How vastly different are those foreign footsteps now. They come to us by radio and televised discussions, vouched for by noble statesmen and cabinet officers, dignified by national acclaim, and certified by congressional loans and agricultural training aids.

Seldom are we buyers of their goods ourselves. Seldom do our oriental and Middle Eastern visitors peddle direct to the curious householders. Great export-import banks and international exchange funds enable our big merchants and even the little, local dime-store dealers to stock their shelves with the wares which once were a wonder and a never-ending delight to the boy beneath the box-elder tree.

It still may be that the avenues of huge metropolitan zones bear signs of the traveling purveyors of amusement and decorative arts. But the little outlying places know them no more, and a sort of glory has departed along with the circus parade and the minstrel bands.

BEFORE you ever went to day school in the brick building three blocks north, the parade of hopeful scholars and their mentors and superiors trod the walks each day on journeys to and fro. The older kids brought you snatches of their favorite school songs and hints of hard lessons facing you in the long years ahead. The slow and dignified footfalls of the principal and the quickly accented walk of the lady faculty passed by your vantage point.

Your Mother had known the principal in legendary days of yore—in that long distant time of her youth and yearning for learning she never fully realized. Being a man and a persistent scholar of local renown, the principal had been able to follow his star and secure his coveted spot as chief of the bookish world in a day when books were honored and wisdom revered. It was her privilege and reward, however, to have the chance to send her children to seek the lodestone of erudition under the approving eye of this ordinary country teacher, risen under the system of his times to be the town's sure symbol of studious living and a constant authority on all matters which grit and muscle alone would not solve.

So it turned out that you spent eight grade years and four terms of high school rudiments in the realm where he was the boss. He must have been a pretty small pickle in the educational patch, and bereft of any degrees or honorary titles (except "professor"). Yet I am certain that most of his old pupils absorbed from him some feeble gleam of what life holds for those who are persistently curious and press for the answers to hidden secrets and unlocked visions from which have come the marvels that man can do. I am sure that old "Prof. Hugh" is up there somewhere, going with measured tread from cloud to cloud, counseling sagely with the Heavenly Board, and dinning more dreams and hopes into the ears of the angels. It is never the volume of learning that you possess which counts. It's the vigor of your faith in it that places the strongest seed in the sprouting mind.

Helpful as he was and fairly progressive as schools go, we know now that there was a trifle lacking in the situation. That difference is made up today in our closer associations between teachers and parents. The PTA units are making over the tie that binds the good teacher to the home. Schools are no longer cloisters where kids are sent to be handled and hustled regardless of the community welfare. The footfalls of our teachers no longer pass figuratively past our doors. They turn in at the gate and talk things over.

ANOTHER rattling wagon sound that often rounded the corner and halted at your cottage door was the farmer's hayrack that carried a load of youthful nature lovers on a picnic. Instead of the usual hayrack, sometimes it was the big carryall from the Brown livery stable. Your lunches were taken along and a high time was had by all. Although you always had chaperones and guides to stabilize your conduct, the fresh and enterprising antics of the older boys went on with vim. Snakes

and toads and frogs were put into the laps of the girls, and more time than food was wasted. Nowadays we have trained natural history leaders to plan and execute the visits to the woods and fields. Courses of a systematic kind cause kids to be more interested in what worms and insects are rather than their value for playful attacks on the timid and the ignorant.

TWO more customary visitors to our childish realm of waiting are members of a clan no longer known or utilized in village ways. I refer to the chimney sweep and the bell-ringing scissors-grinder. To this list might also be added the most colorful character we had in our town, the man who came on winter nights to light the glimmering gas lamps. We would sit in the gloaming and listen to the nighthawks as fall arrived, waiting for the advent of that fast-stepping, nimble personage who mounted the iron frame and lifted the glass to apply the flame. And do you recall how kids gathered to get the discarded carbons when they cleaned and renewed the hanging arcs at corner ways?

In the days before chain stores almost every town had independent tradesmen who made regular daily deliveries—but, of course, not by virtue of telephone messages. Your father or mother went down there and looked everything over, and put in a direct order. The filling and lugging were up to the merchants. So we can add the red-haired butcher boy to the list of those who came dashing into the small world of the growing child under the box-elder tree. He drew up with a bang, tossed out a flat iron weight fastened to the horse's halter, and hustled into the kitchen bearing those bulky packages of meat and lard. We all remember how that brown butcher paper looked, heavy and coarse, with threads of dark wood fiber in it. When you paid up your bill at intervals, the appreciative butcher sent over a link of "boloney" or a pound of calf's liver as extra gratuity to a provident household. To linger any length of time on comparative prices would hit so hard at the traditions of the present-day meat handlers' union that even the printers might rebel for the sake of maintaining unity in an inflated world. The only "unions" our village butchers and their helpers enjoyed were the union suits they wore.

We may also add to the list of comers-no-more another example of local industry. A retired farmer bought himself a power wood-saw which was operated by a gasoline engine. He and a hired man paid visits each fall to the back yards and alleyways to set up his outfit near a few cords of wood your folks bought from the big uptown wood yard. Denizens of that neighborhood all day long heard the staccato beat of the engine and the piercing screech of the saw when a stick of wood was pushed against the buzzer. But to sundry small boys with plans of their own choice for Saturday afternoons, this rapid mechanical method of disposing of a nasty sawing chore was the world's finest invention.

ONE could go on endlessly, recreating in the mind's eye all of the almost forgotten routine events and innovations that crowded past the box-elder tree and its faithful companion. The day the local company marched self-consciously away to war. The proud day of their return, minus several footfalls that would no longer keep in step with anyone. The glorious Fourth and its resounding noises beyond the front fence. Marvels seen in the wake of the blaring bands which escorted the cages and the clowns on circus day. Runaways careening past the house, with a scared driver in frantic effort to keep the team headed straight.

We still have the soldiers—surprisingly boyish and youthful, at least

compared with the tall elders we looked at when the volunteers bore the brunt of other wars. The Fourth is celebrated yet, but mostly far away from the village square, at some mighty race track or other sporting spot. It's much improved too, with less lost lives and legs from giant crackers, once common sources of tragedy and illness. The gaudy and resplendent circus still visits our largest places, but the morning parade with its thrills has been laid away in mothballs long since. You just have to take it on faith and its advertised reputation now. The violent equine runaway has completely died out. Now it is customary to try and educate the driver to be careful and cautious. Old-time runaways could not be prevented by appealing to the equine's horse sense—but it seems sometimes that not much better results have come from appealing to human minds in the way of reducing highway accidents.

BUT the clearest and dearest memory relates to parental footfalls that have ceased to come your way along a quiet street in many, many years. They and their meaning and the reasons for it always remain. Your Dad's firm footfalls brought anticipated news and views from folks he'd seen up town, and that sense of security and safety that hovers around a home which has a "good egg" for its director. And Mother's being away from the place was so infrequent that her familiar steps brought a sense of business and breakfasts as usual, and a desire on your part to be "square" and truthful when she asked you leading questions. One often pauses to listen—usually in the silence of a summer's night—thinking that off there somewhere, maybe just around the next corner, you can catch the exact rhythm and beat their footsteps make. Not ghostly ones or disturbing ones, but calm and reassuring ones—beating lightly as their possessors come back again to find the waiting kid beneath the box-elder.

Time Proven LaMotte Soil Testing Apparatus

LaMotte Soil Testing Service is the direct result of 30 years of extensive cooperative research with agronomists and expert soil technologists to provide simplified soil testing methods. These methods are based on fundamentally sound chemical reactions adapted to the study of soils, and have proved to be invaluable aids in diagnosing deficiencies in plant food constituents. These methods are flexible and are capable of application to all types of soil with proper interpretation to compensate for any special soil conditions encountered.

Methods for the following are available in single units or in combination sets:

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The American Potash Institute will be pleased to loan to educational organizations, agricultural advisory groups, responsible farm associations, and members of the fertilizer trade the motion pictures listed below. This service is free except for shipping charges.

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Potash Production in America (Sound, running time 25 min. on 800-ft. reel.)

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IMPORTANT

Requests should be made well in advance and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of loan.

Request bookings from your nearest distributor.

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The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

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Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Better Corn (Midwest)
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THE AMERICAN POTASH INSTITUTE

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While crossing the college campus, a freshman met one of his instructors and said, "What's your guess about the game next Saturday. You don't think we'll do too bad, do you?"

"Don't you mean 'badly'?" inquired the professor.

"What's the difference?" said the freshman. "You know what I mean."

"An 'l-y' can make quite a difference," said the professor. He pointed to a passing co-ed:

"For instance, it makes a difference whether you look at her sternly, or at her stern."

* * *

"It isn't the things in the Bible I don't understand that worry me; it's the things I do understand."—*Mark Twain.*

* * *

The oldest inhabitant was being interviewed by a newspaper reporter.

"And to what do you attribute your longevity?" he was asked.

"Eh?" queried the old man, who was rather deaf.

"Your longevity," repeated the reporter.

"Oh so far as I can remember," was the reply, "I never had one."

* * *

A little girl was sent to the drug store for something to stop palpitation. Since it was a long walk to the store, and the girl had a short memory, here's what she said to the druggist: "Mother said she wanted something that will stop population."

Poor old Hiram! He went up to New York determined to make his living pulling some skin games on innocent strangers. However, the first fellow he tried to sell the Brooklyn Bridge to turned out to be the owner of the darned thing, and if Hiram hadn't paid him ten dollars to keep quiet they would have had him arrested.

* * *

Probably nothing in the world arouses more false hopes than one good cantaloupe.

* * *

At the conclusion of a lecture in which the professor hoped to drive home to even the simplest minds the fundamental aspect of relativity, he said:

"I might put it this way. If you sat on a hot stove for a minute, it would seem like an hour. But if a beautiful girl sat on your lap for an hour, it would seem only a minute. That, in brief, is relativity."

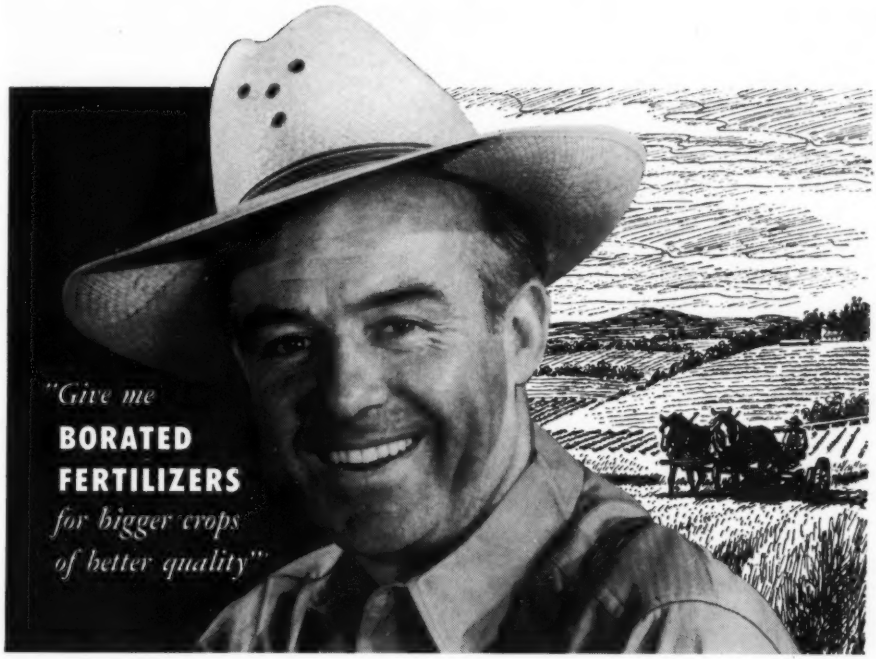
"So?" said a disgusted voice from a rear seat. "From such nonsense a man like Einstein makes a living?"

* * *

"We can't take care of you," the hostess of the hotel told him, "unless you can make arrangements to share the bed of the red-headed school teacher."

With superb indignation the traveling man said, "I want you to understand that I am a gentleman!"

"So," responded the hotel hostess, "is the red-headed school teacher."



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FERTILIZER BORATE (*equivalent to approximately 93% Borax*) and FERTILIZER BORATE-HIGH GRADE (*equivalent to approximately 121% Borax*) come in fine mesh for addition to mixed fertilizer, or coarse mesh for direct application where required. This material saves you important money in cost of transportation, storage and handling, etc., because water content is held to approximately 24% water (5 mols). County Agents or State Experimental Stations should be consulted for detailed recommendations. Write today for literature!

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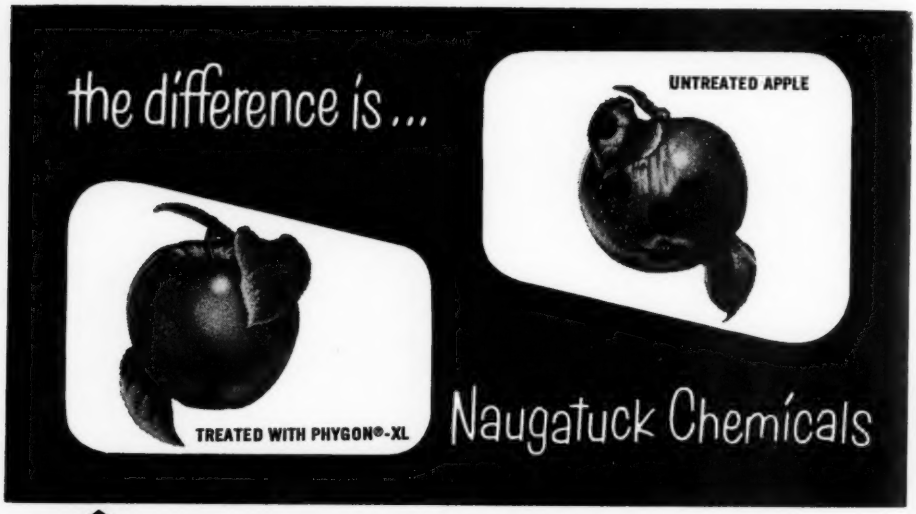

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